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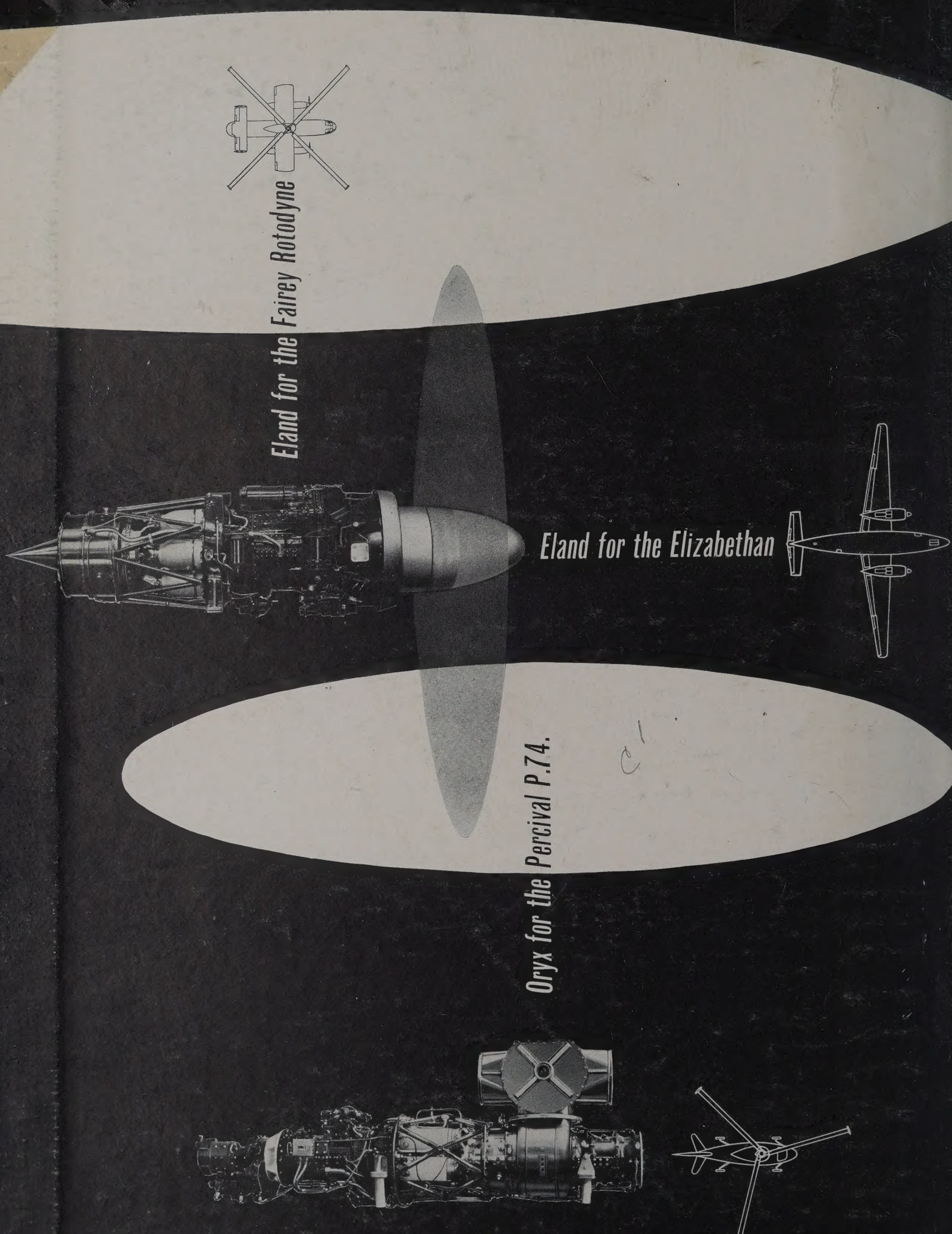
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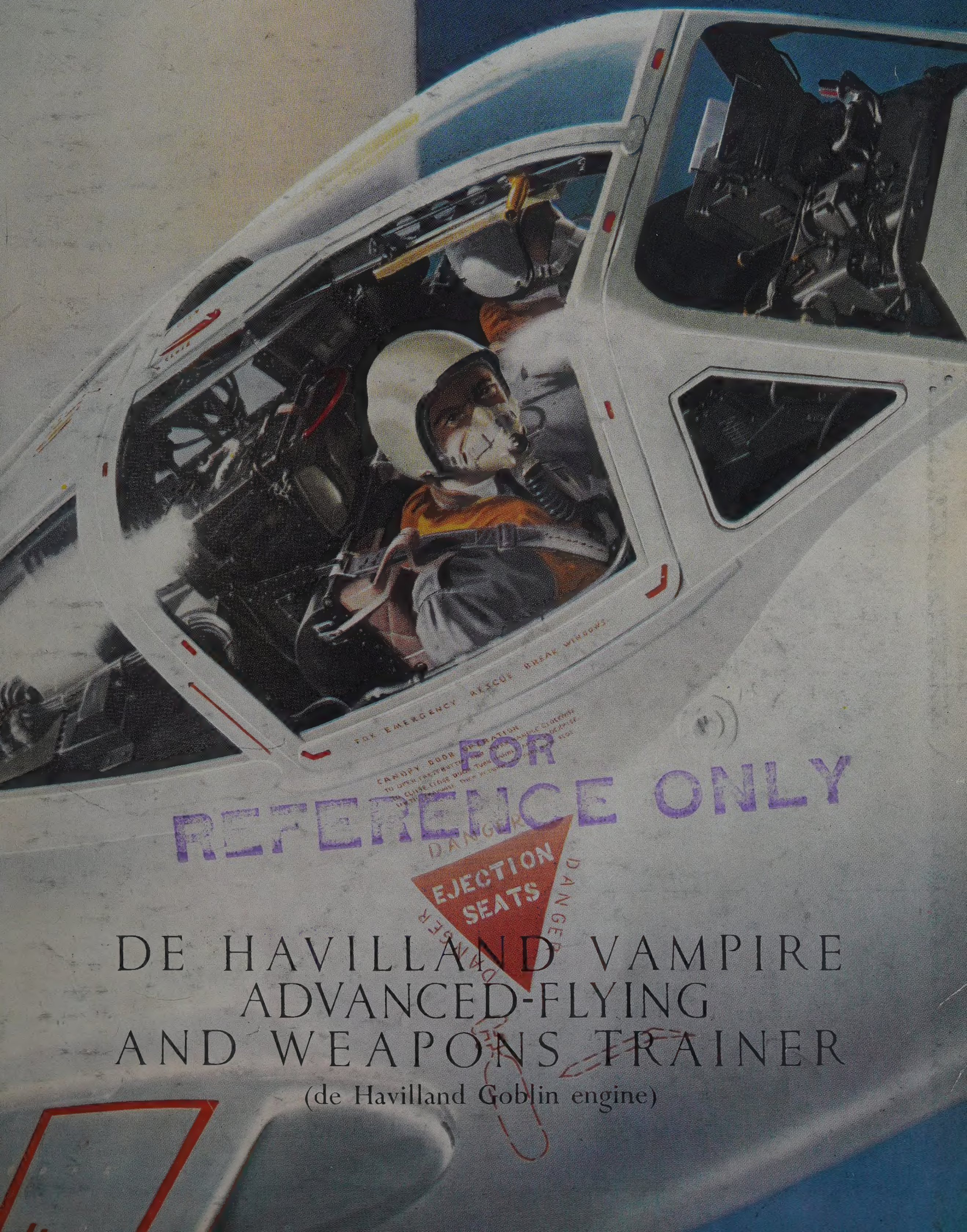

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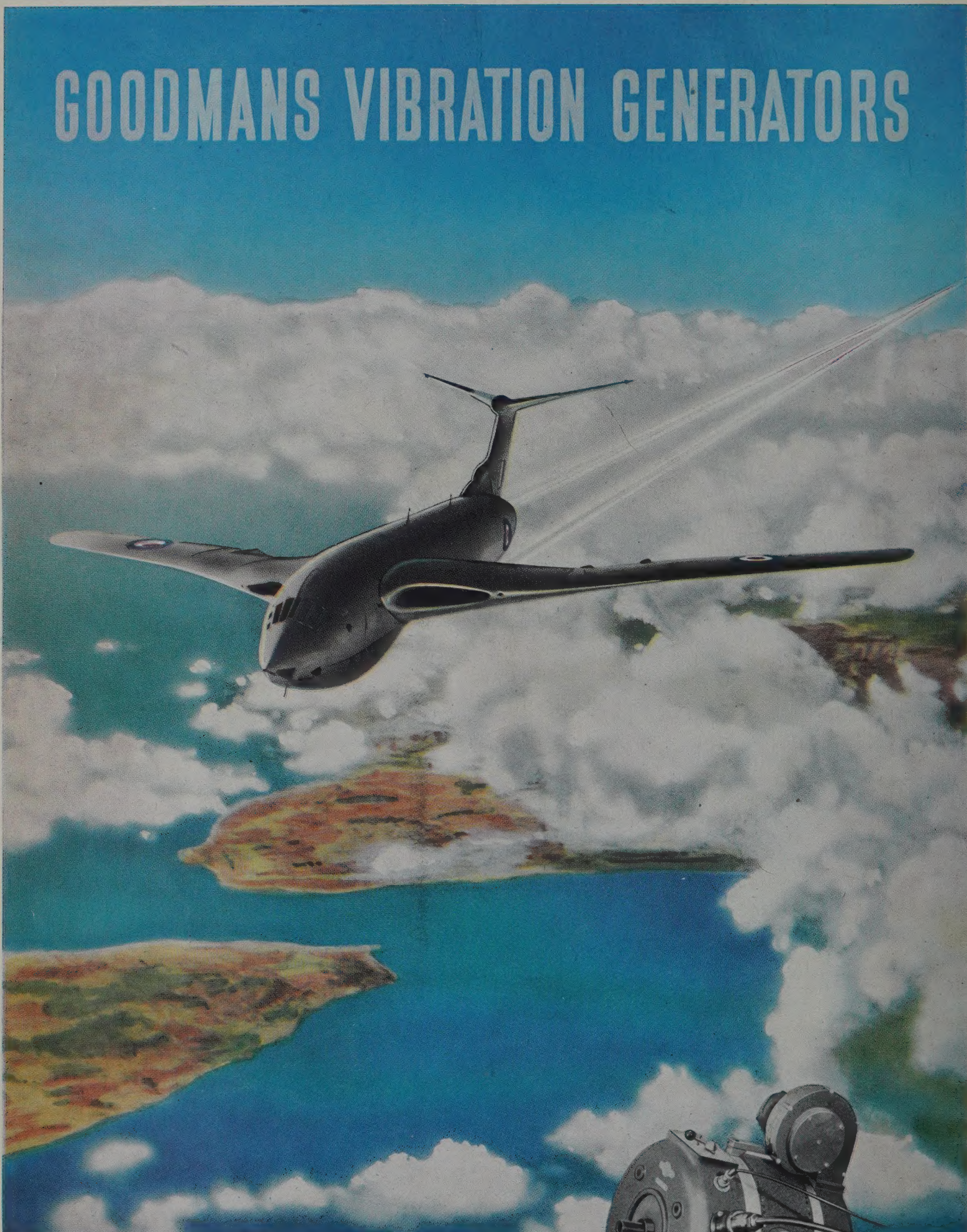

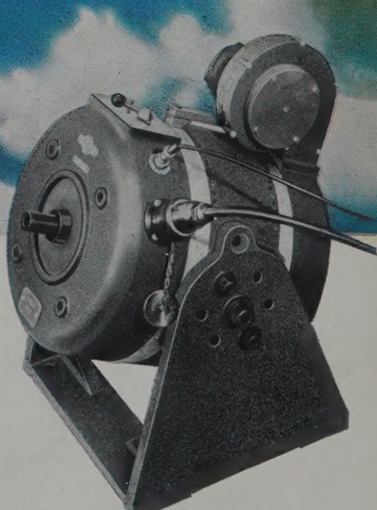

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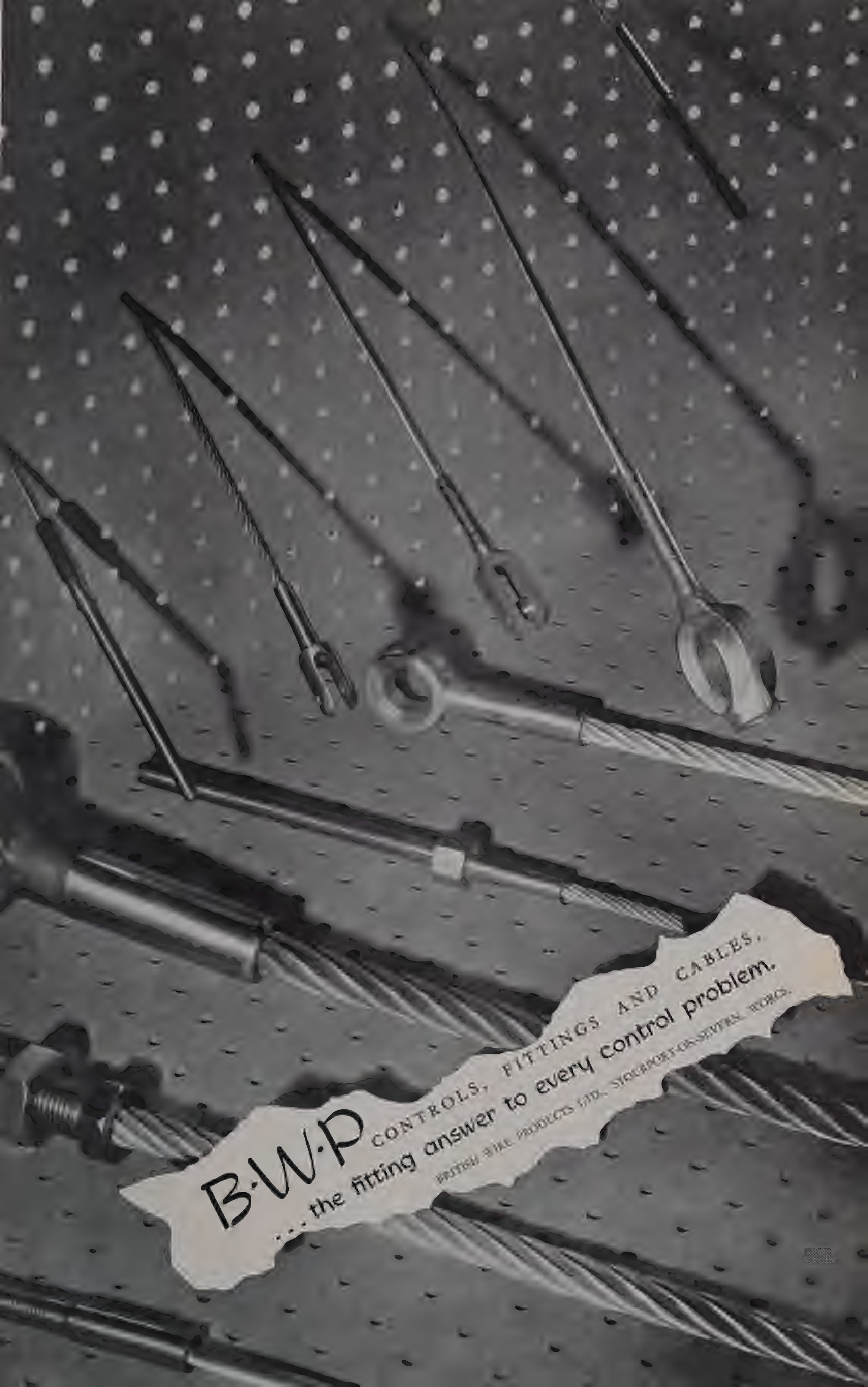
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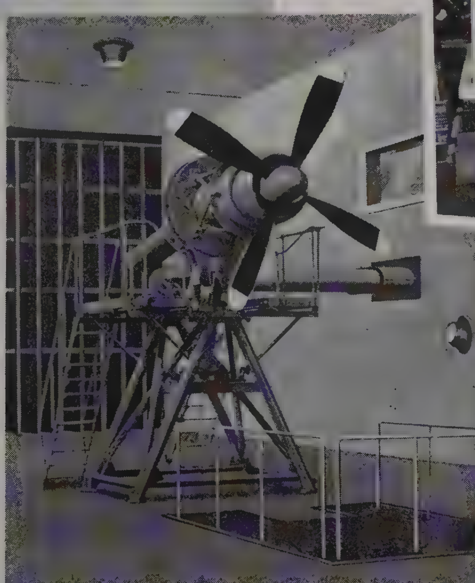

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Right: Model of Torque-Reaction Hangar Stand.

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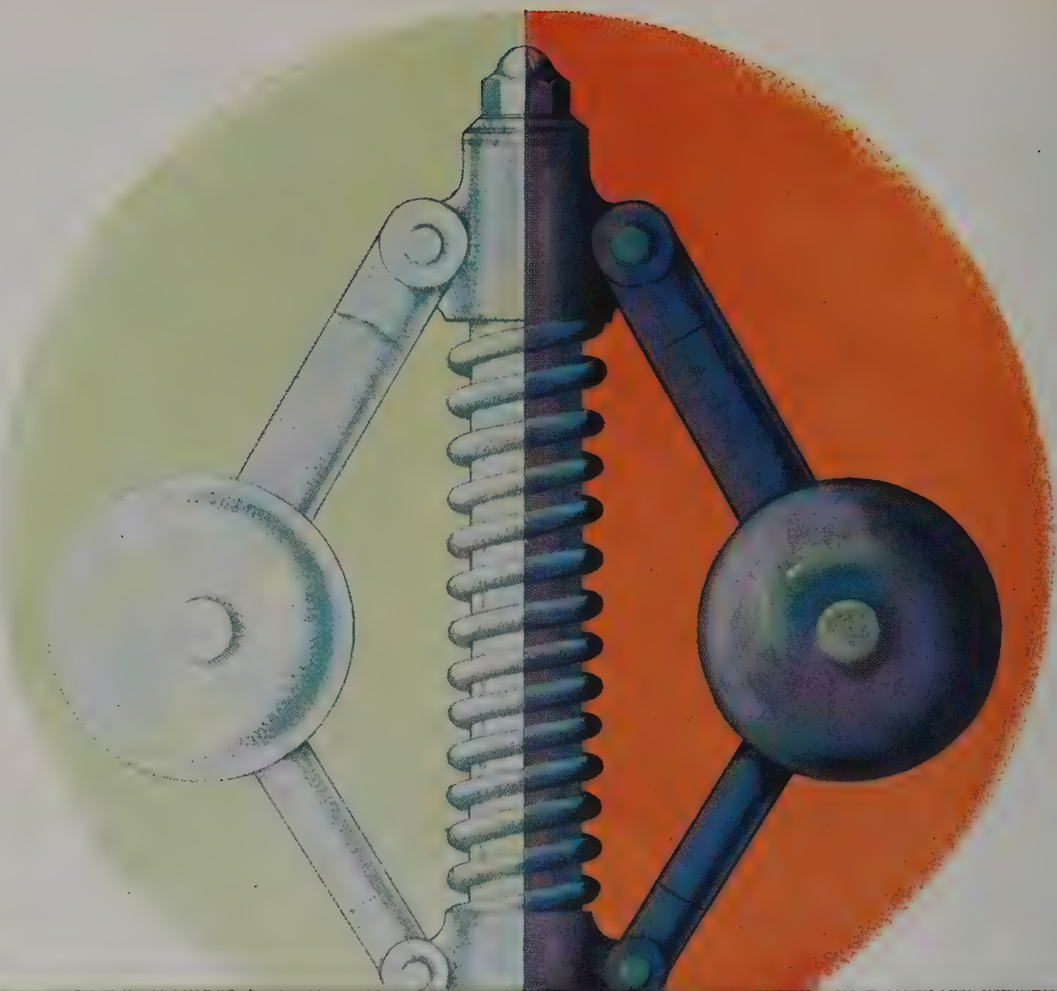

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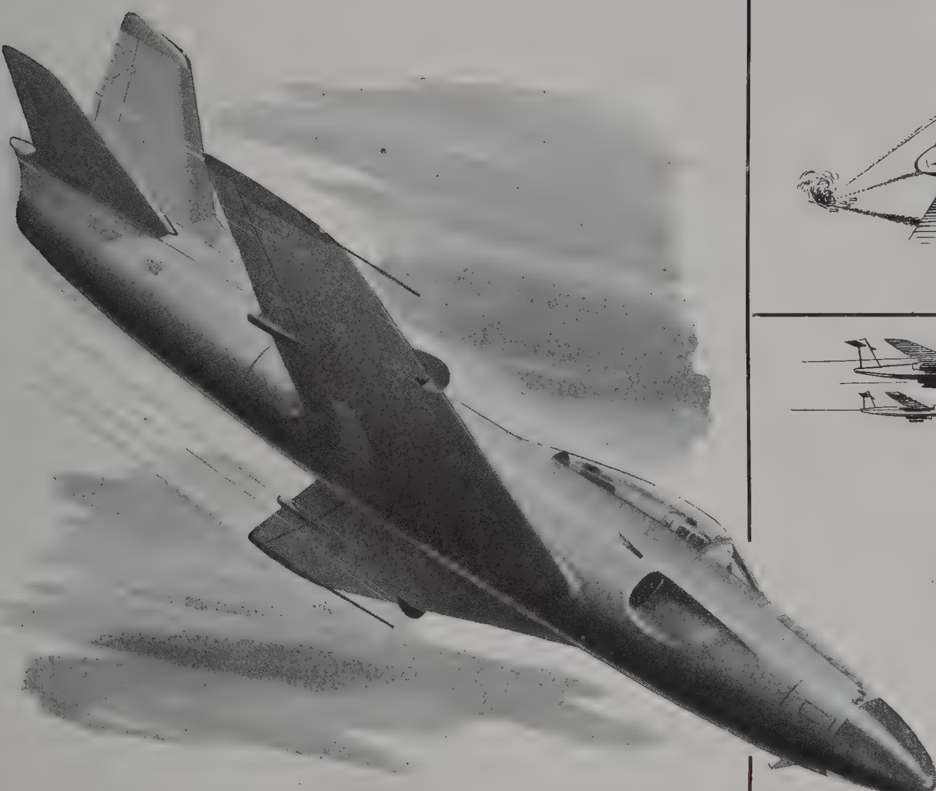

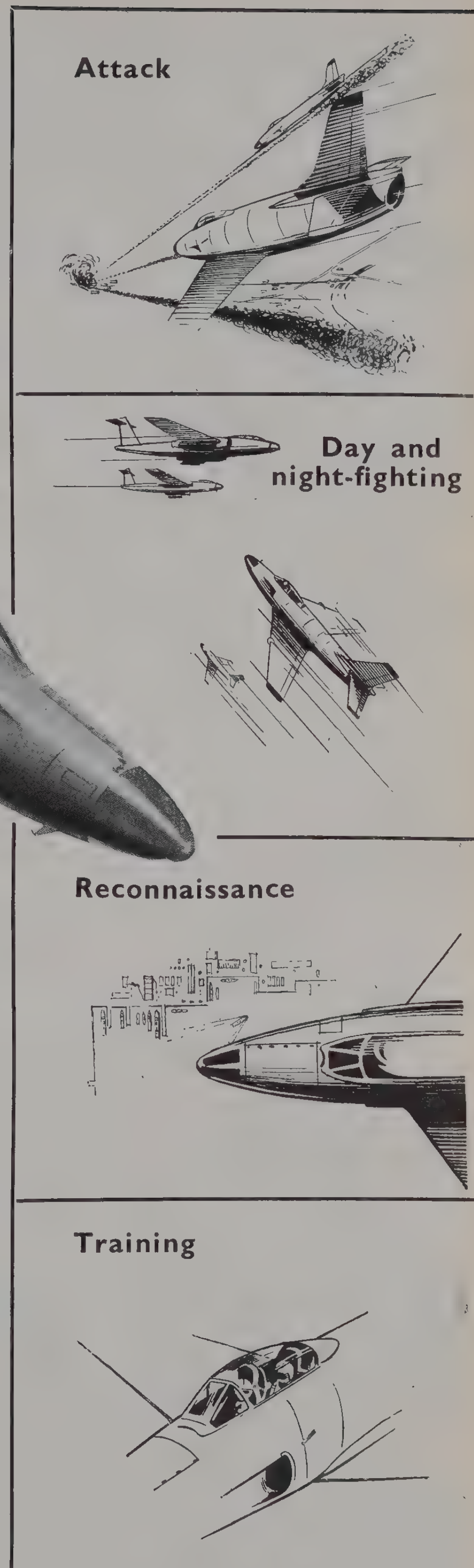

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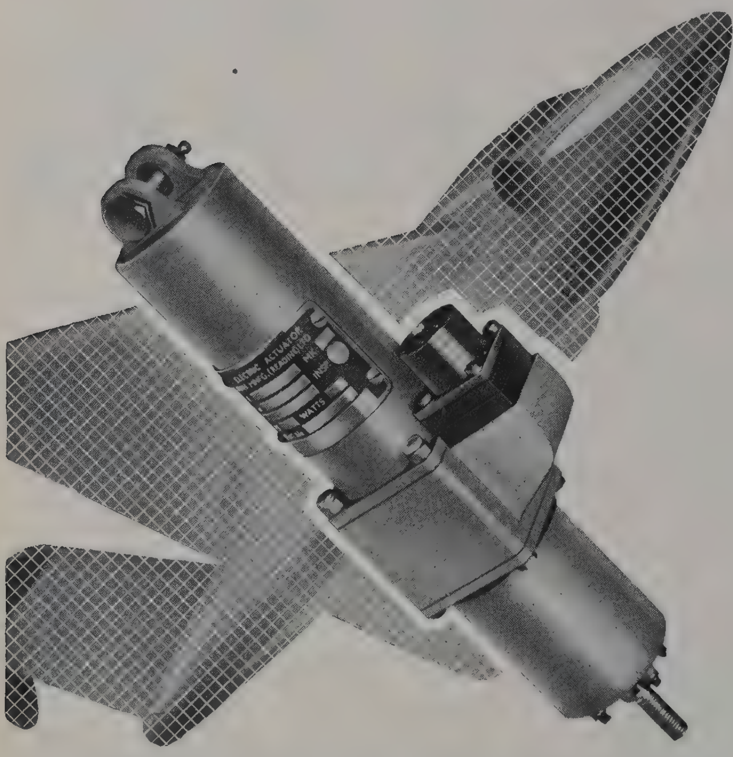

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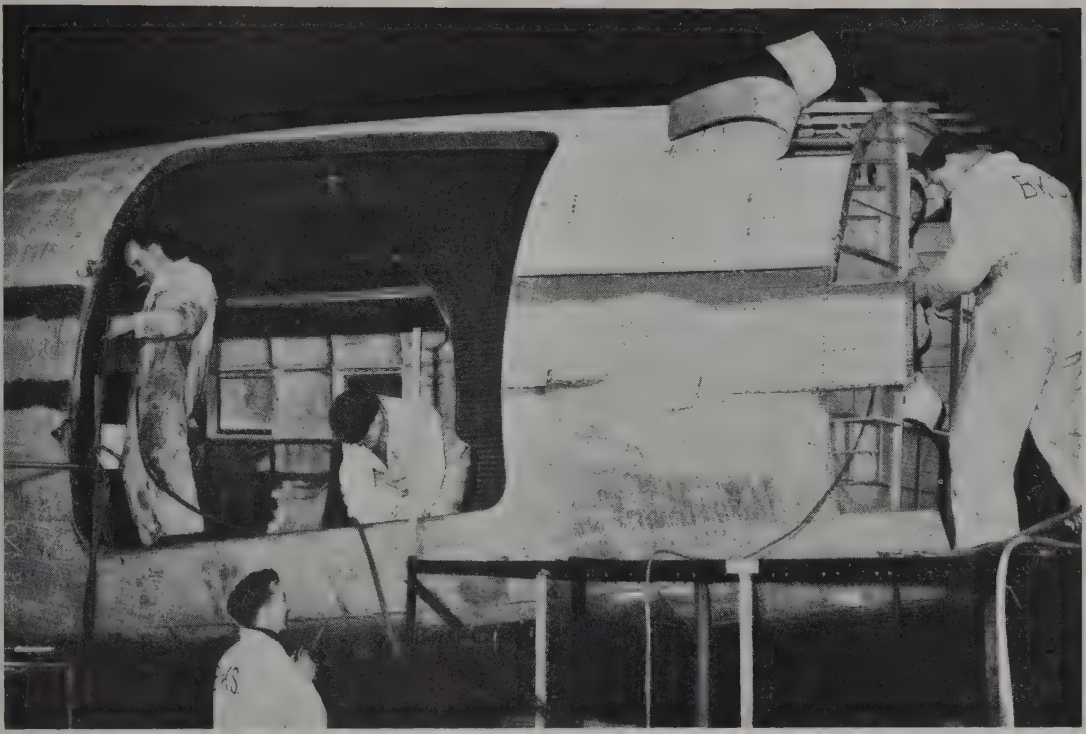
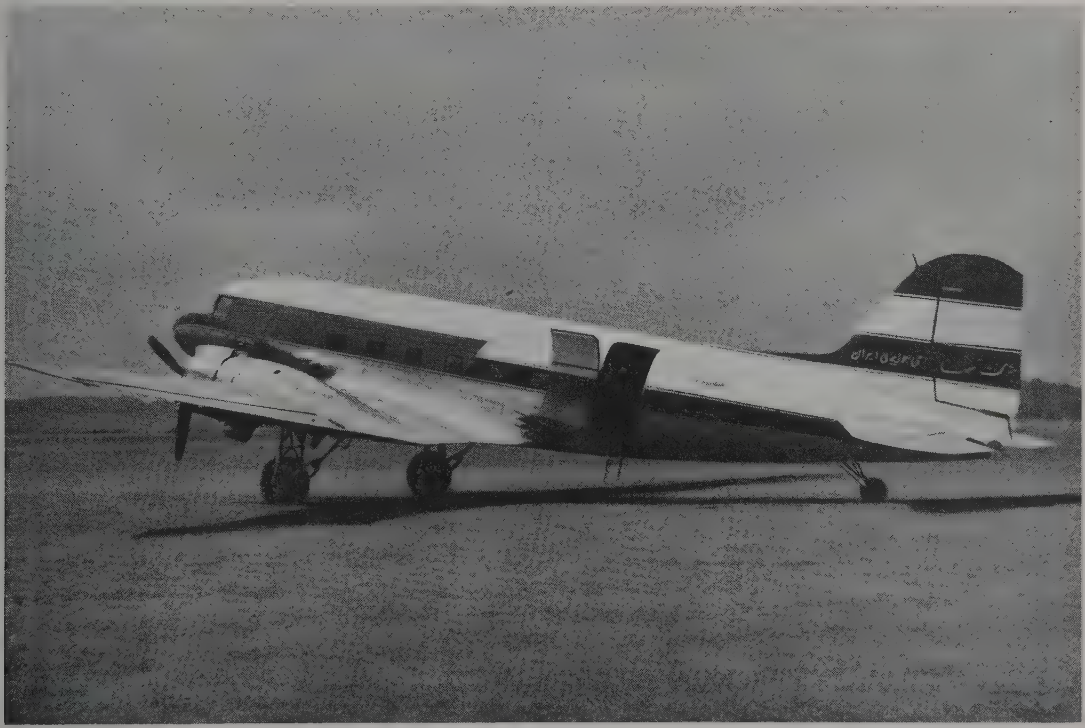
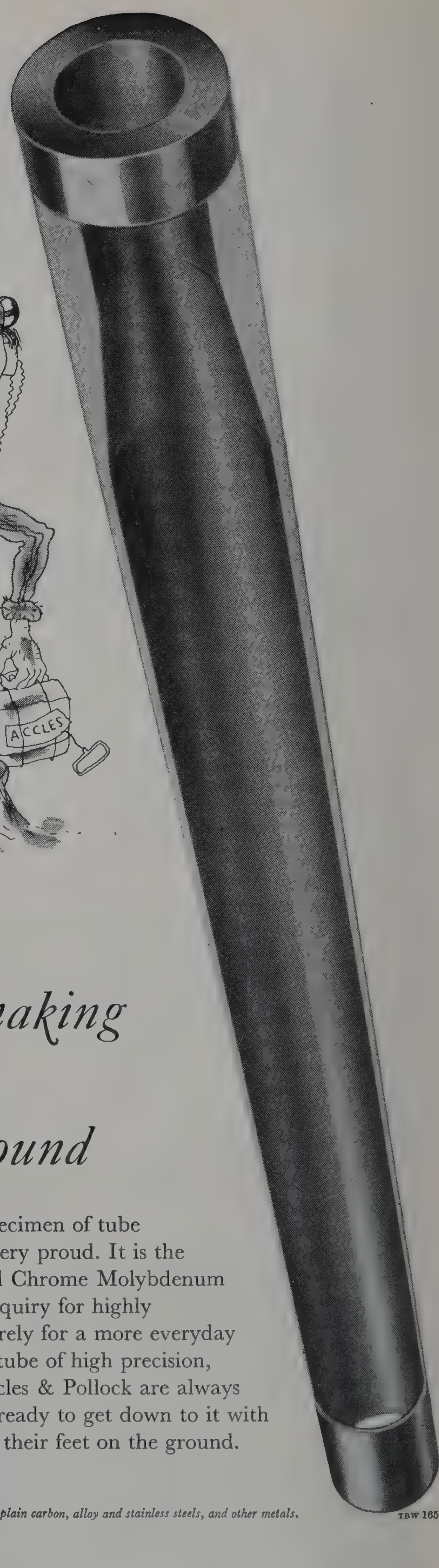


A replacement tail section was spliced on to the damaged fuselage and the whole area of the joint reskinned.



The aircraft, which was at first considered a complete write off, was then flown back to the Middle East within ten weeks of its arrival.



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still have their feet on the ground

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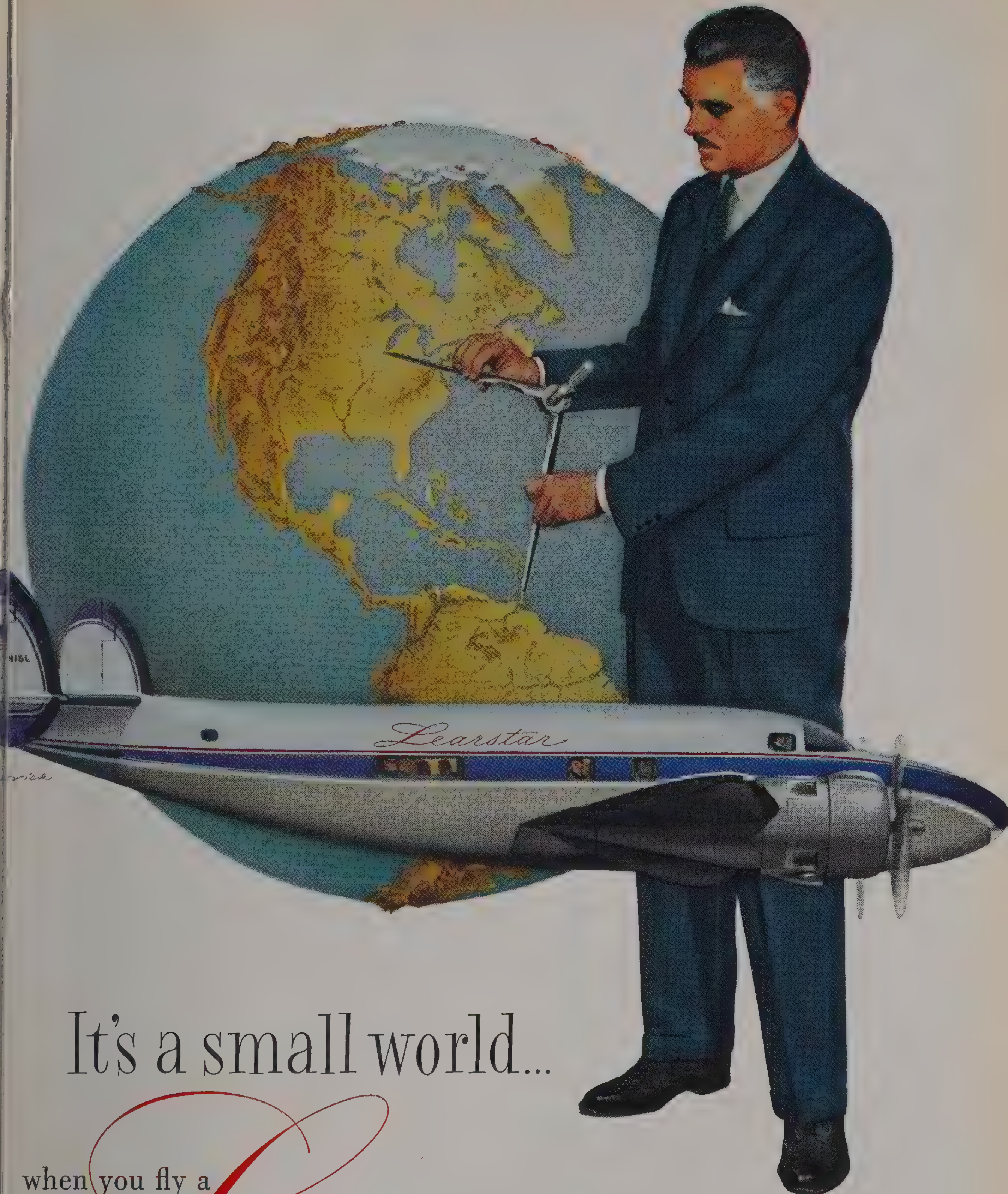
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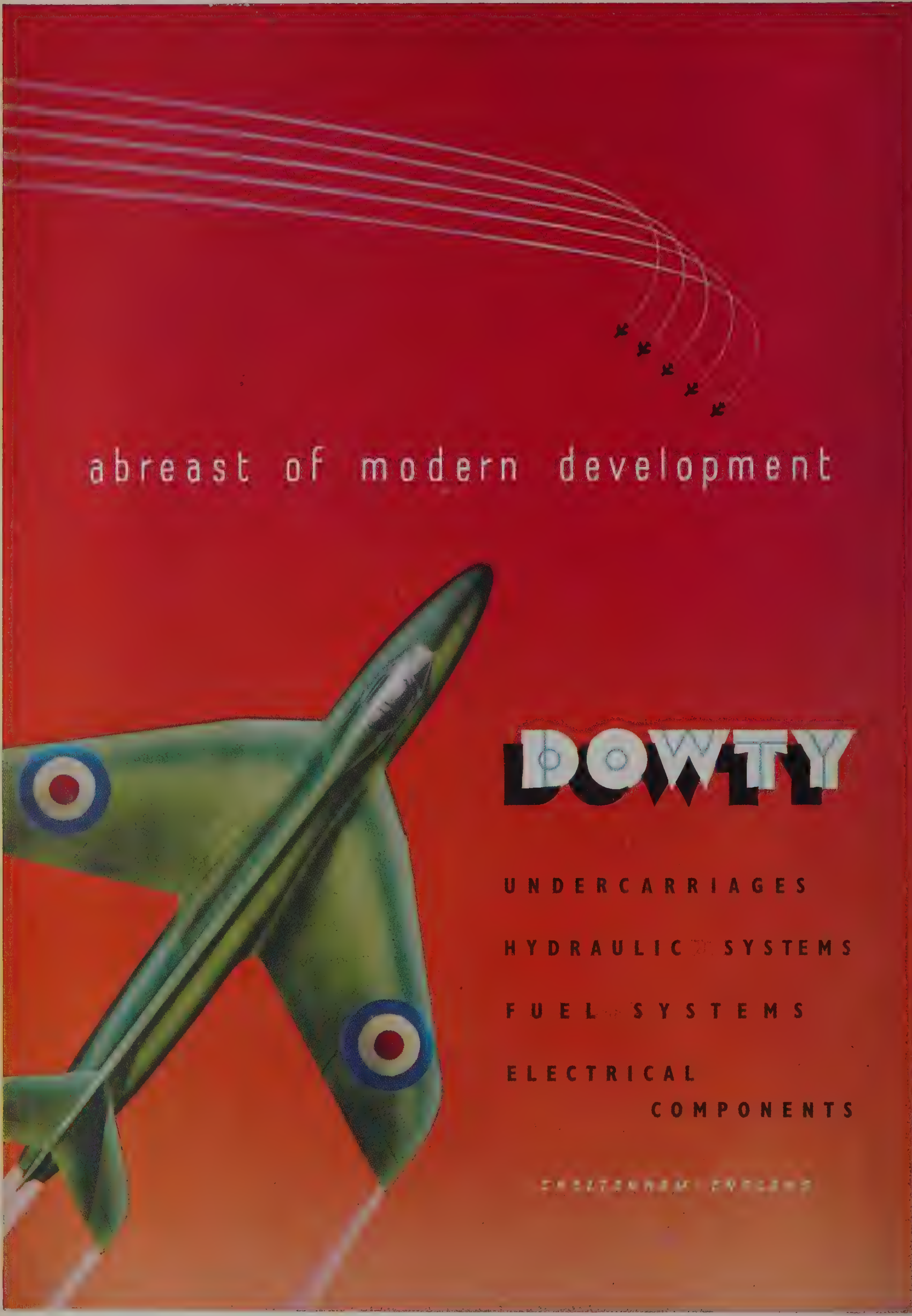
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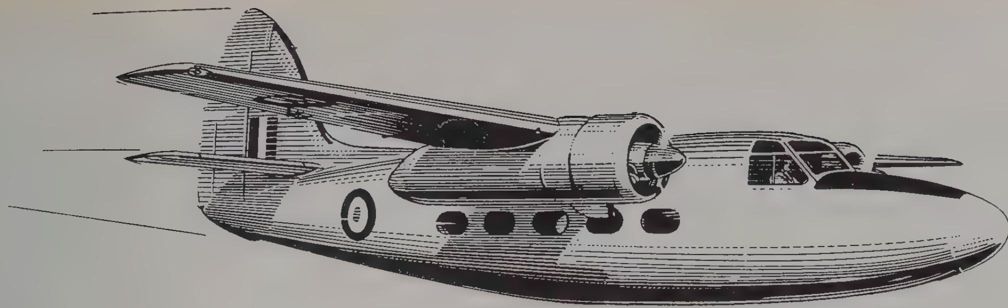

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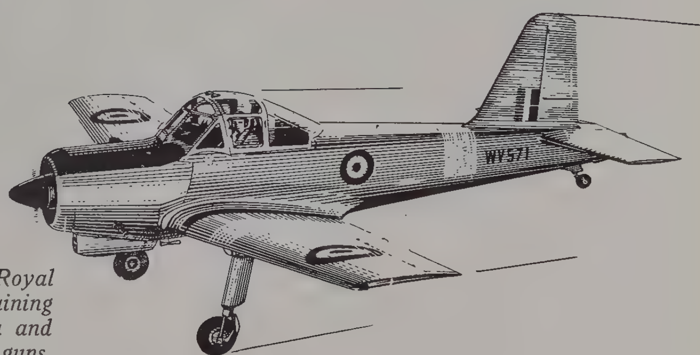

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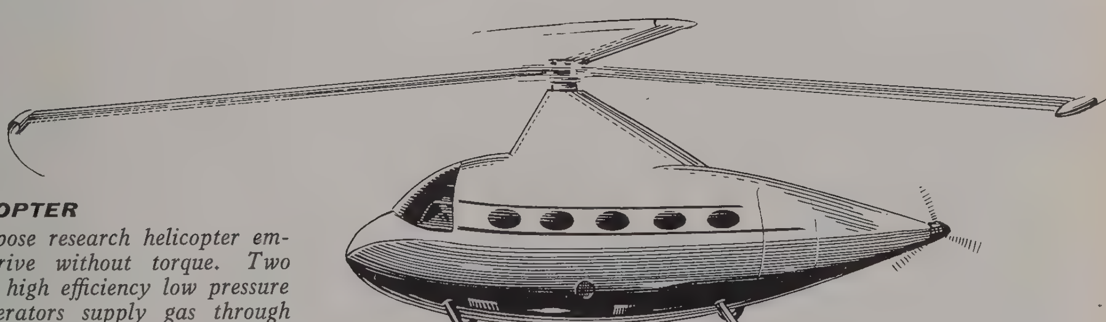

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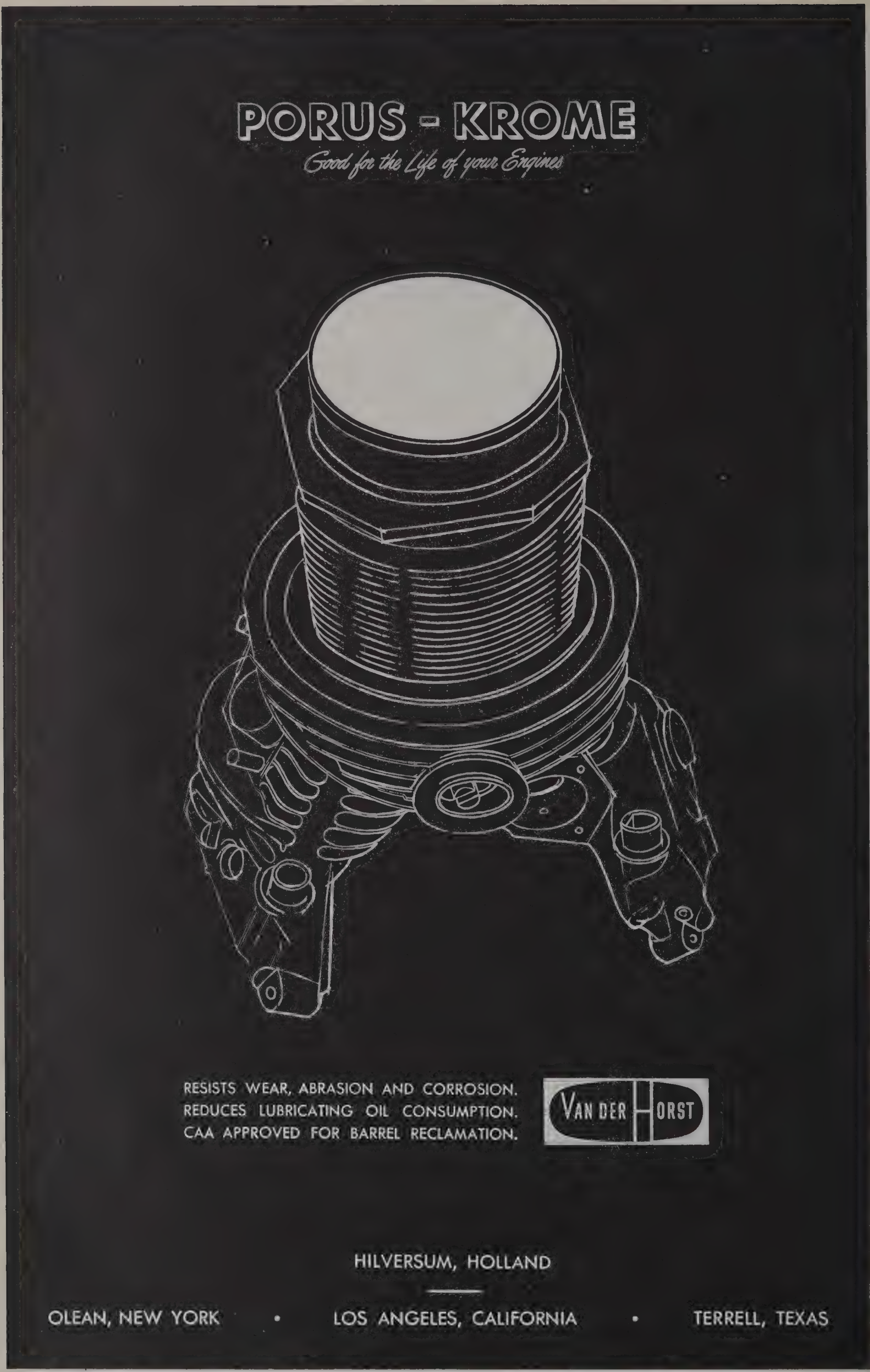
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- Efficient in operation for both search and strike.

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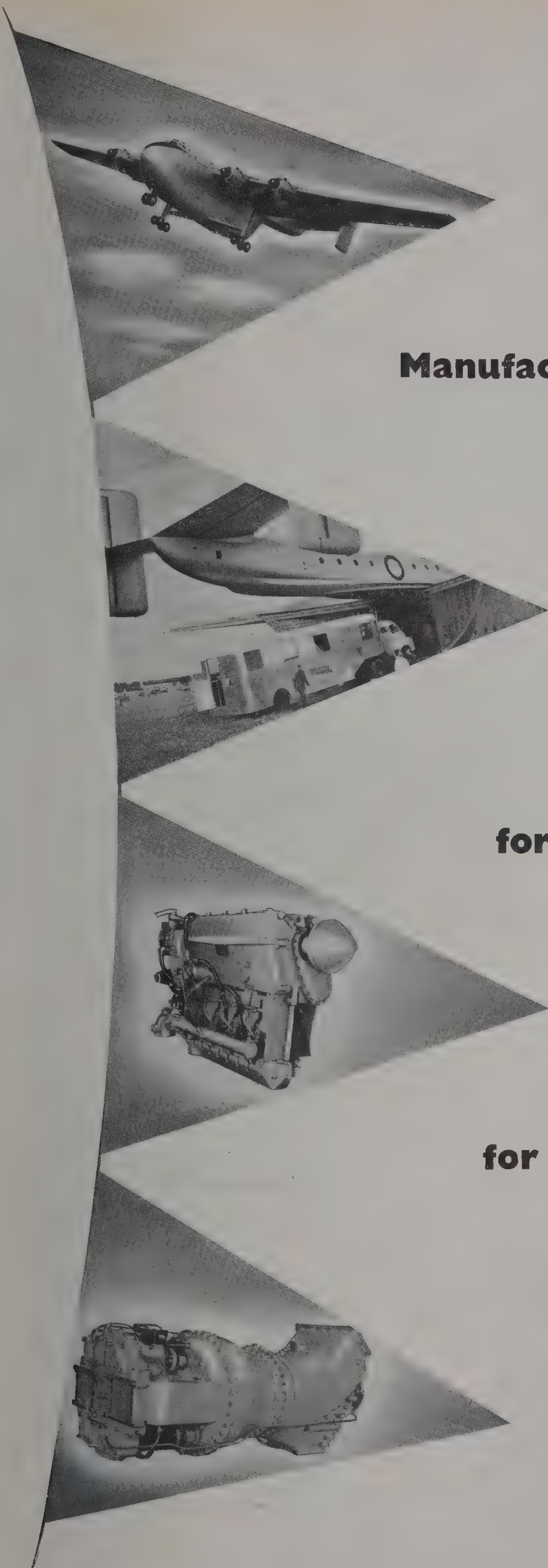

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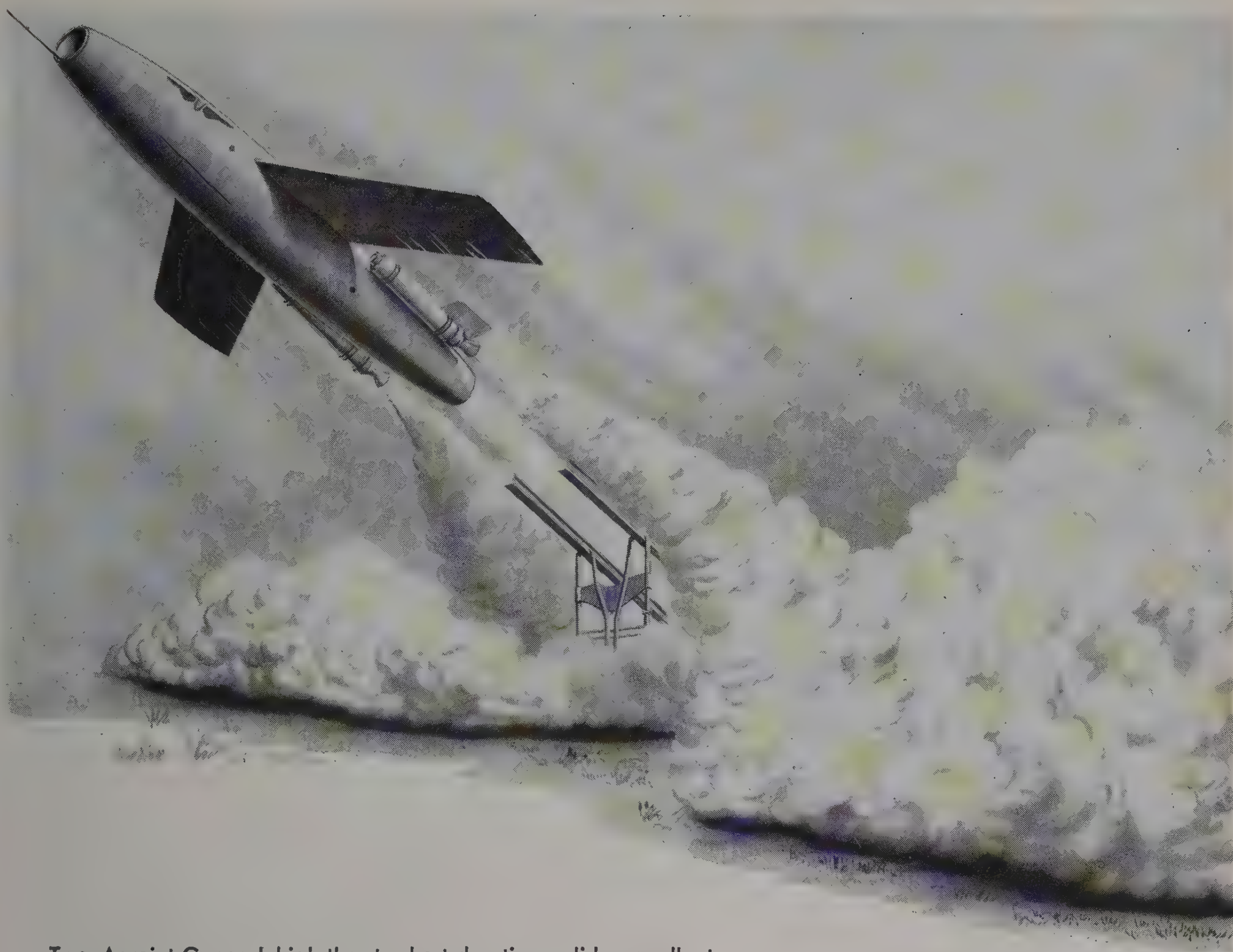

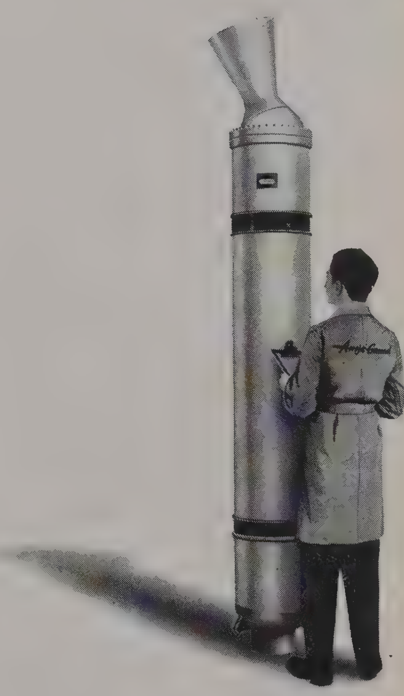

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Carrying over 11 tons payload, the combat-proven C-119 airdrops fully-equipped troops and bulky cargo in forward areas—while the rugged C-123 actually lands on unprepared terrain in the most advanced bases, with full protection to personnel and equipment.

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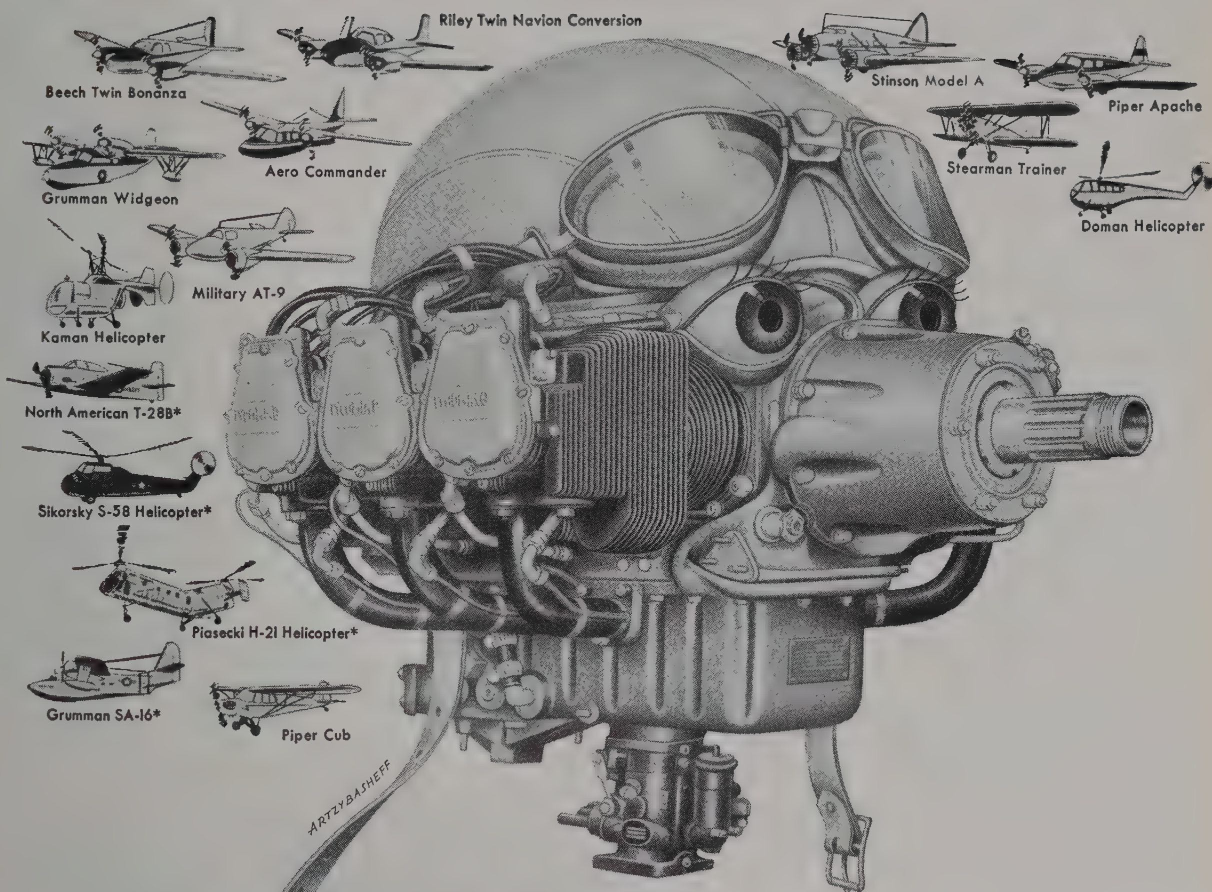
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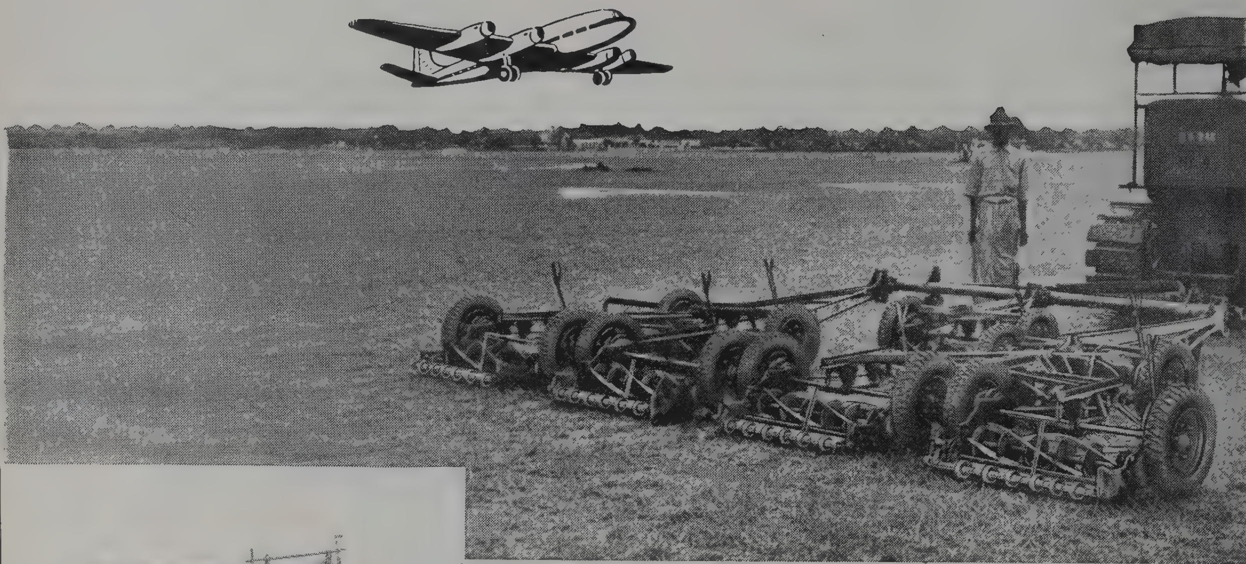

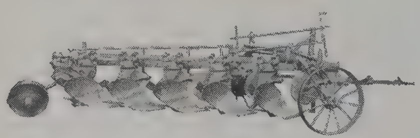

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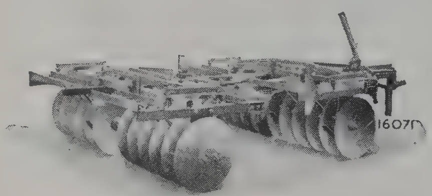

TANDEM DISC HARROWS. For soil preparation after ploughing, before sowing grass seed.

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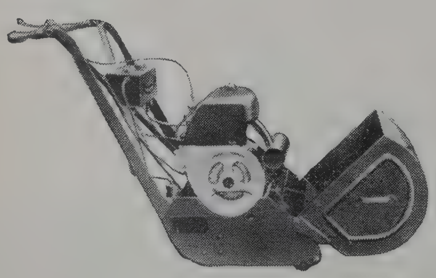

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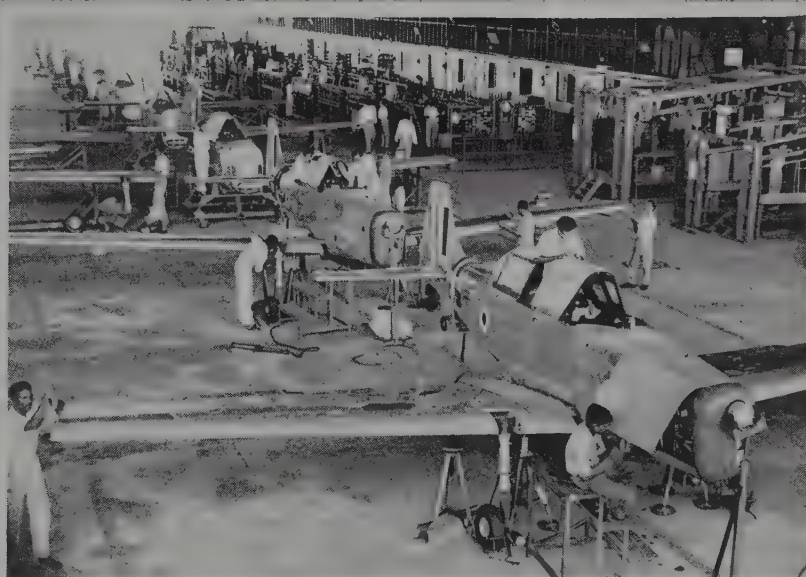

The HT-2 selected by the IAF for primary training is now in full production, and deliveries can be made in batches. Export of the aircraft has been permitted by Government. Demonstrated at the Ceylon Air Rally, the HT-2 has been acclaimed there as the most suitable basic trainer for Air Forces and Flying Clubs.

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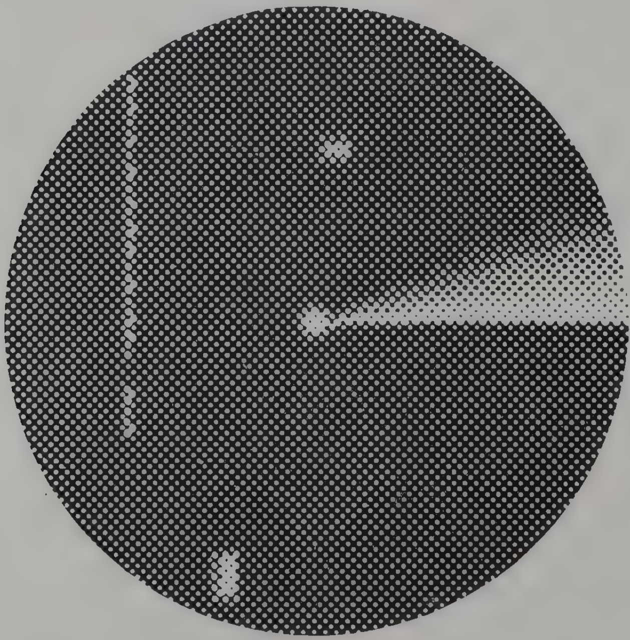

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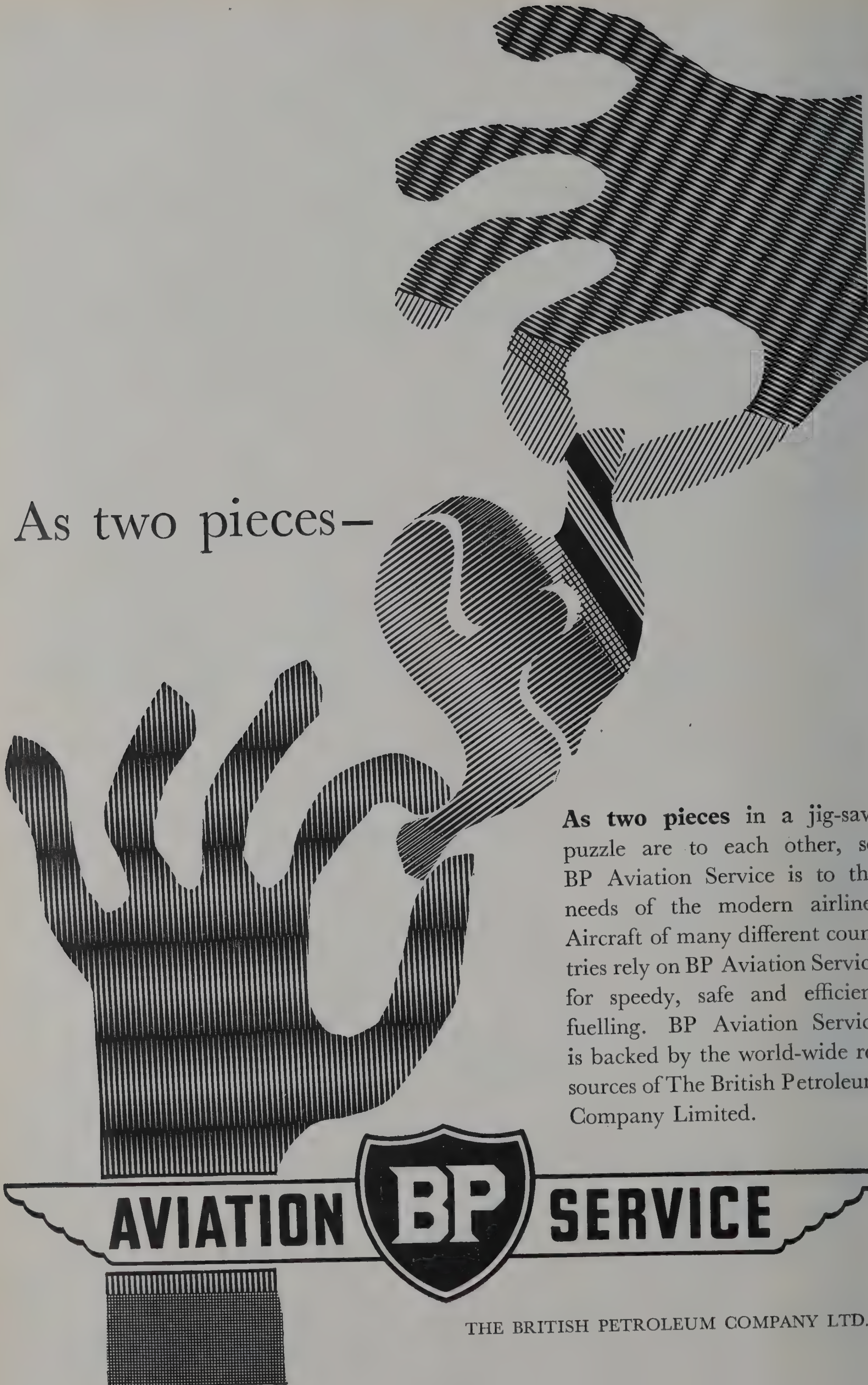

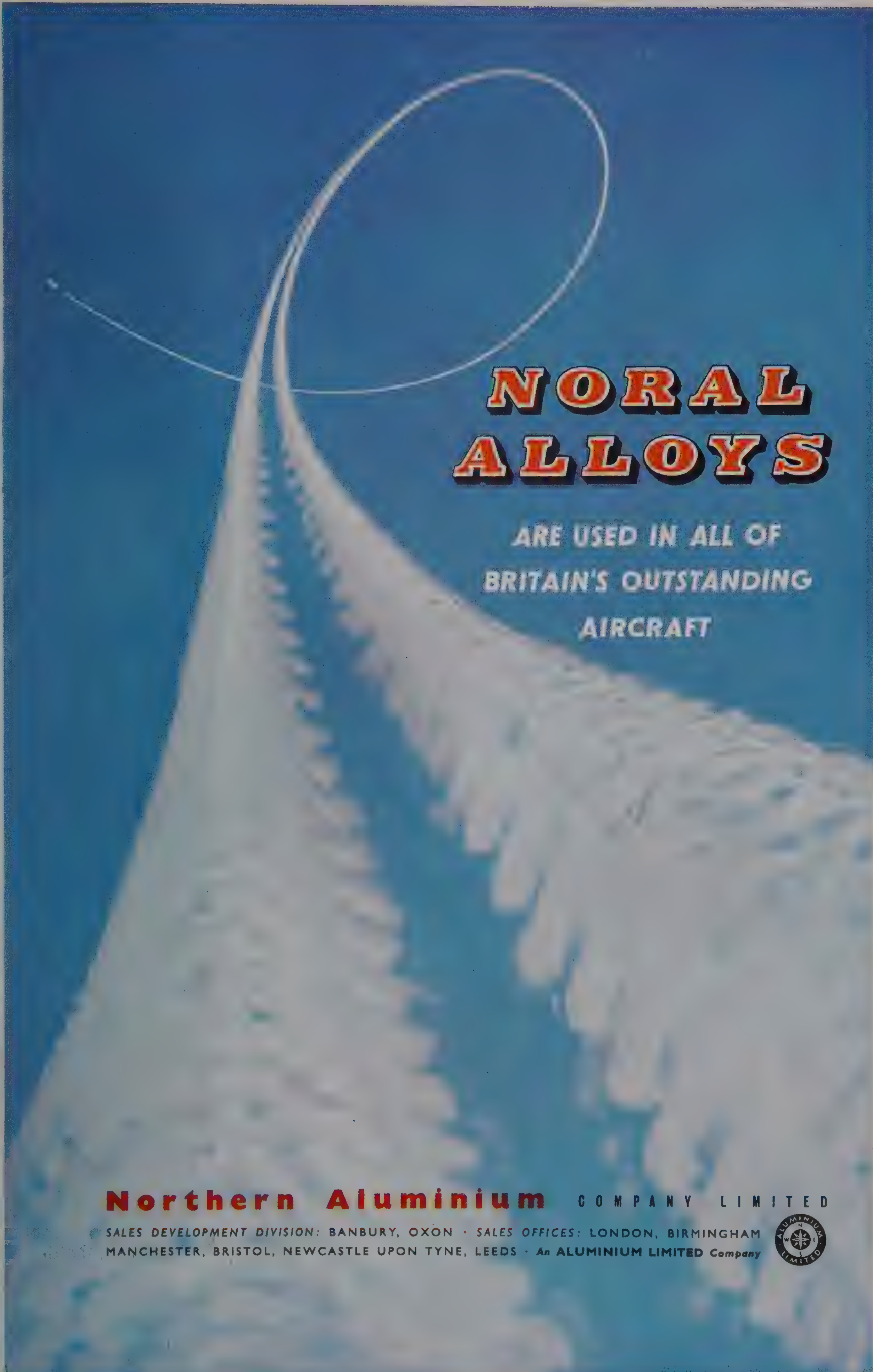
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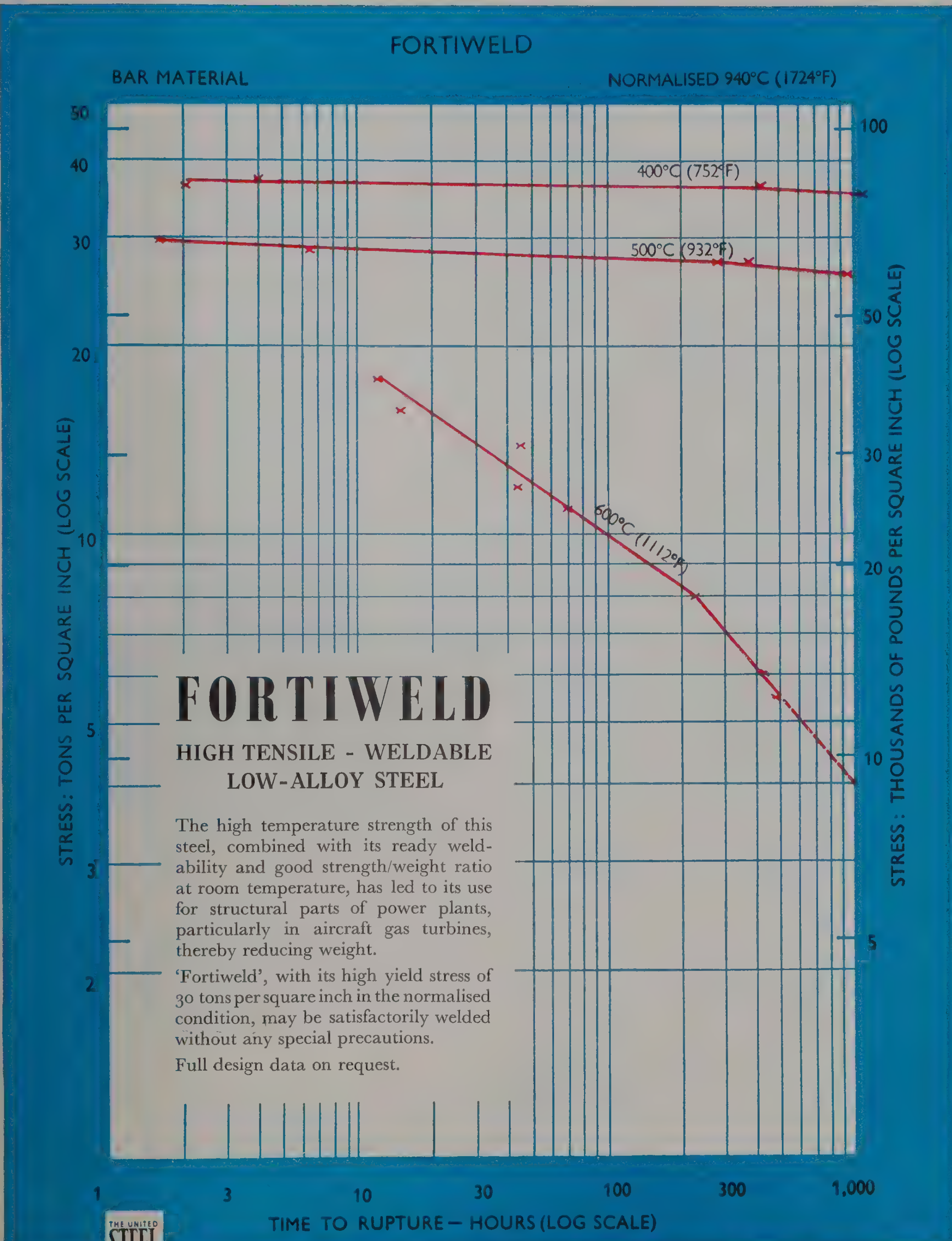

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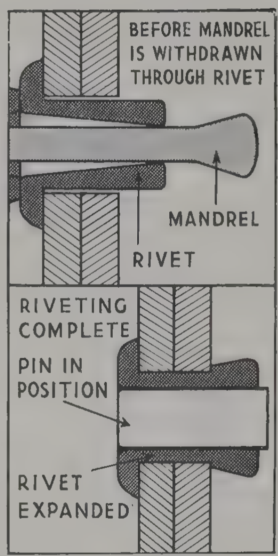

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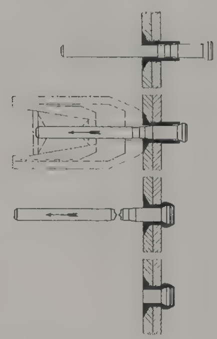

- Rivet and Mandrel in position in skins
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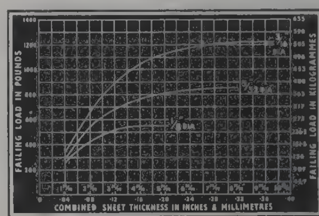

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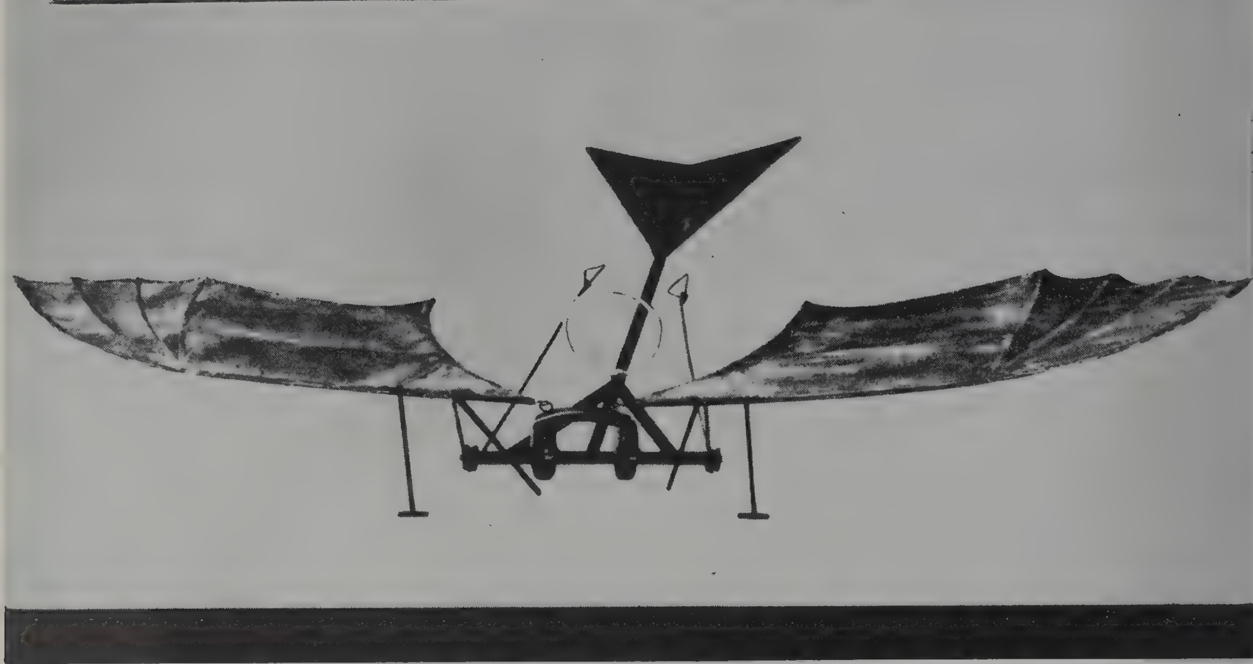
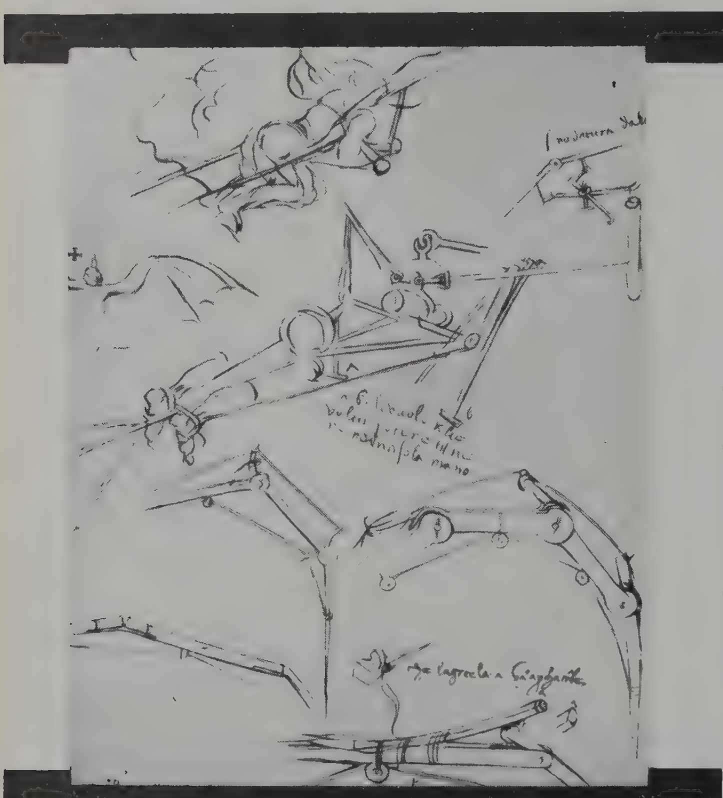


First Plans for Mechanical Flight



"If I find that this instrument made with a screw be well made — that is to say, made of linen of which the pores are stopped up with starch — and be turned swiftly, the said screw will make its spiral in the air and it will rise high."

These are not words of a visionary but the careful notes of the man who gave the world its first detailed plans for mechanical flight — Leonardo da Vinci. Over 400 years ago he made a careful scientific investigation of the mechanics of bird flight, planned in detail the helicopter and parachute, and constructed many test models of flying machines. Always seeking improvements, he died with his work unfinished.

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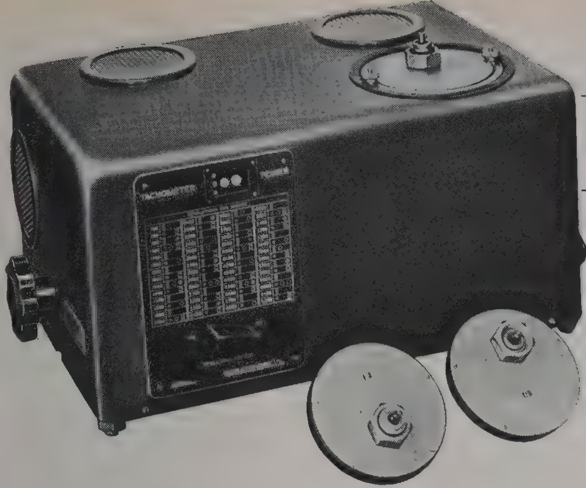
Flight deck of H.M.S. Warrior taken during exercises in the Japanese Inland Sea



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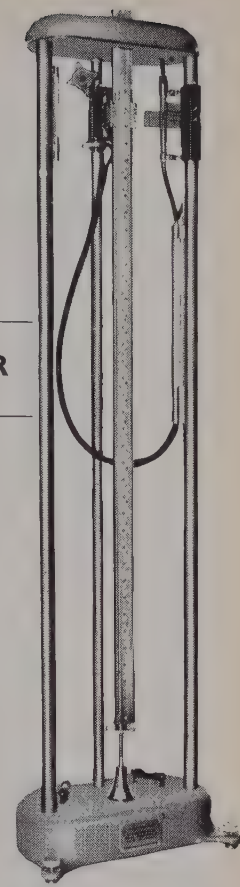

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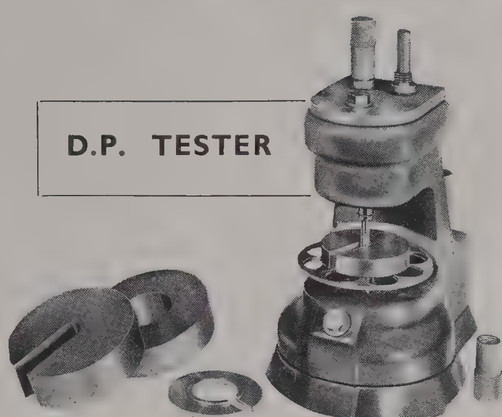

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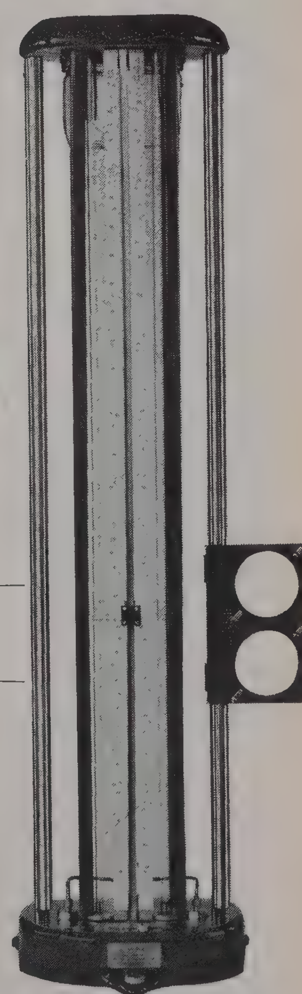

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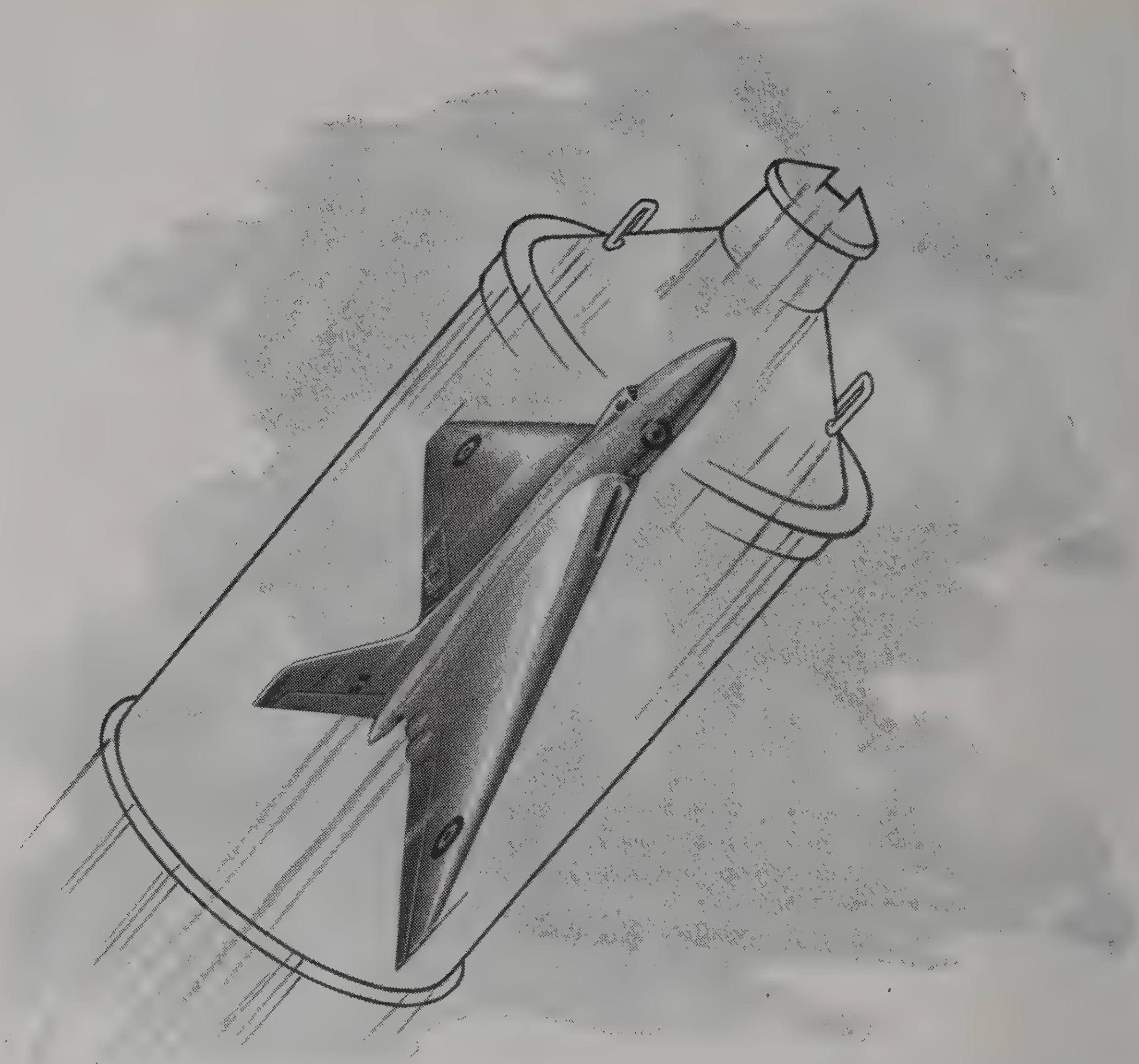

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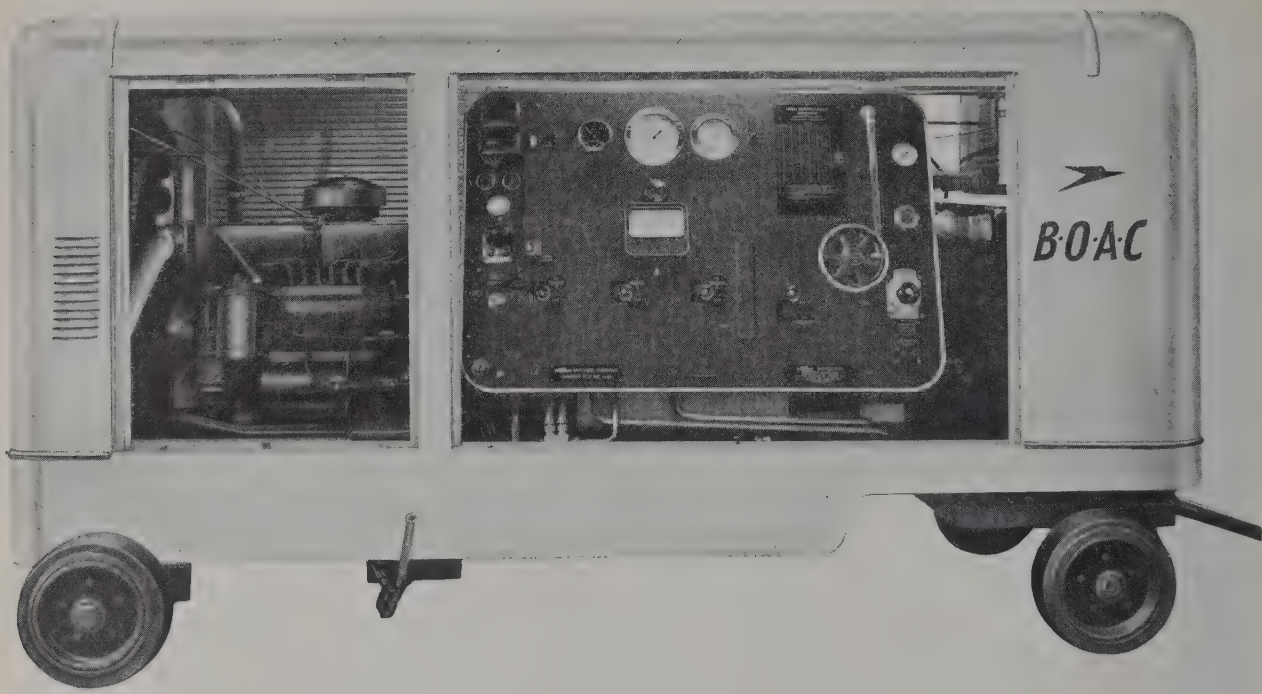
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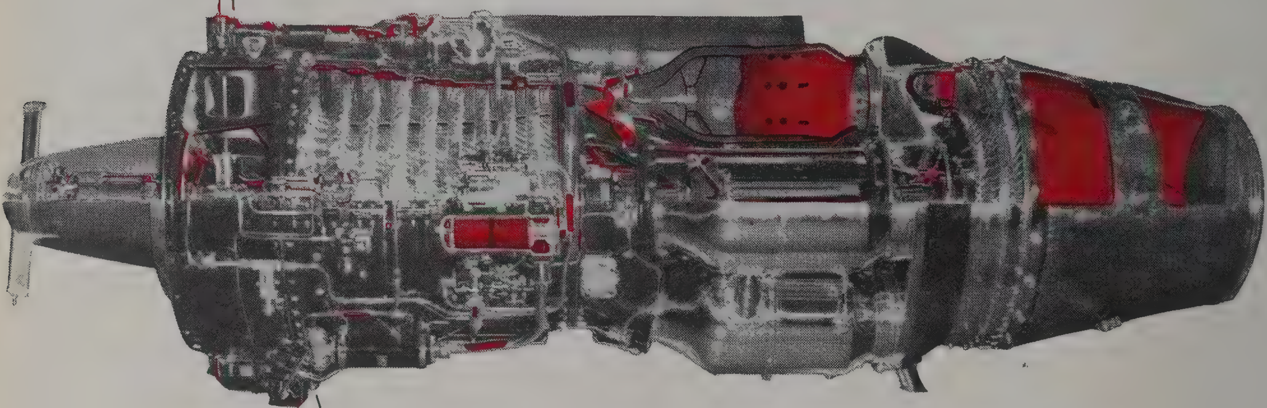

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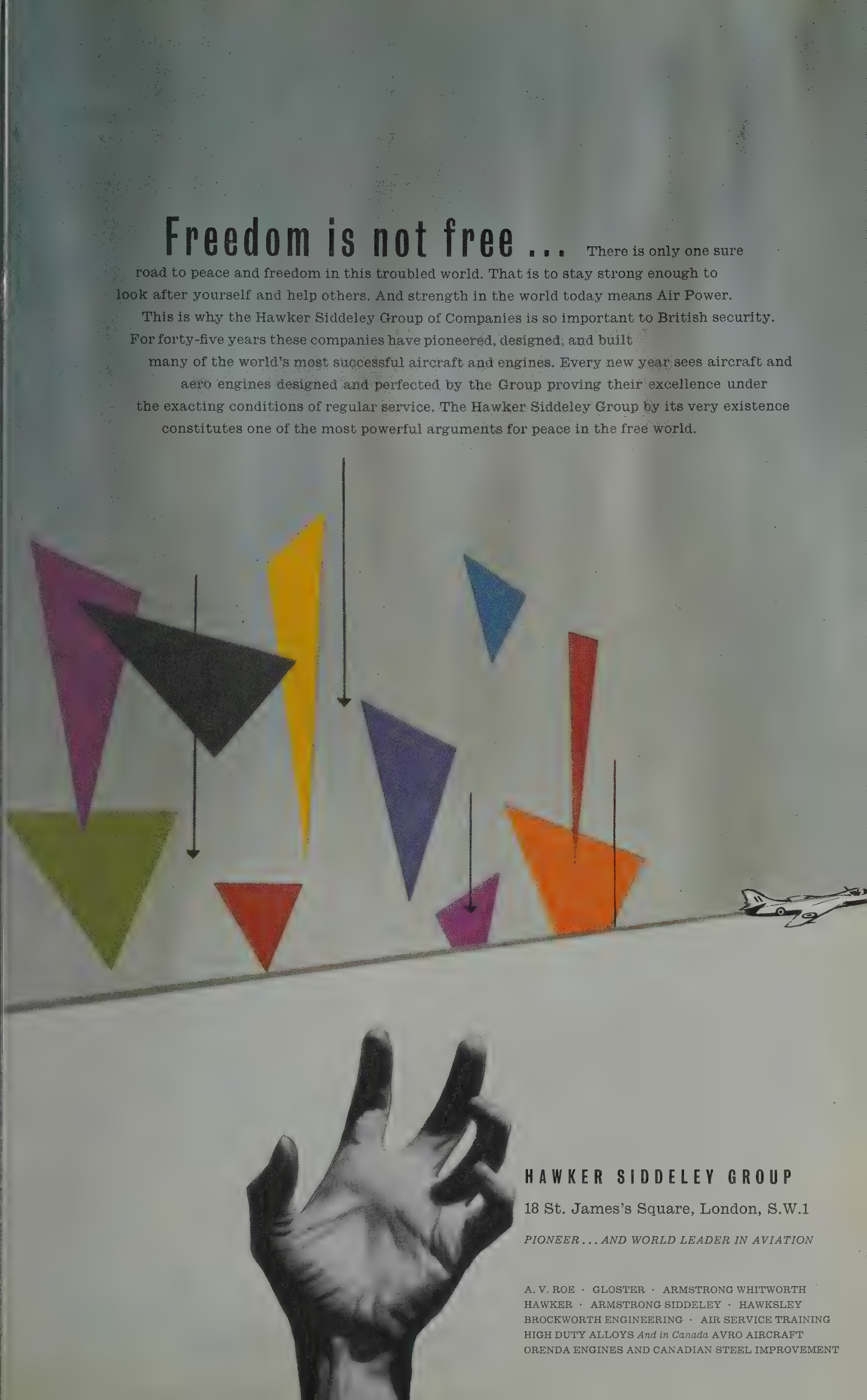
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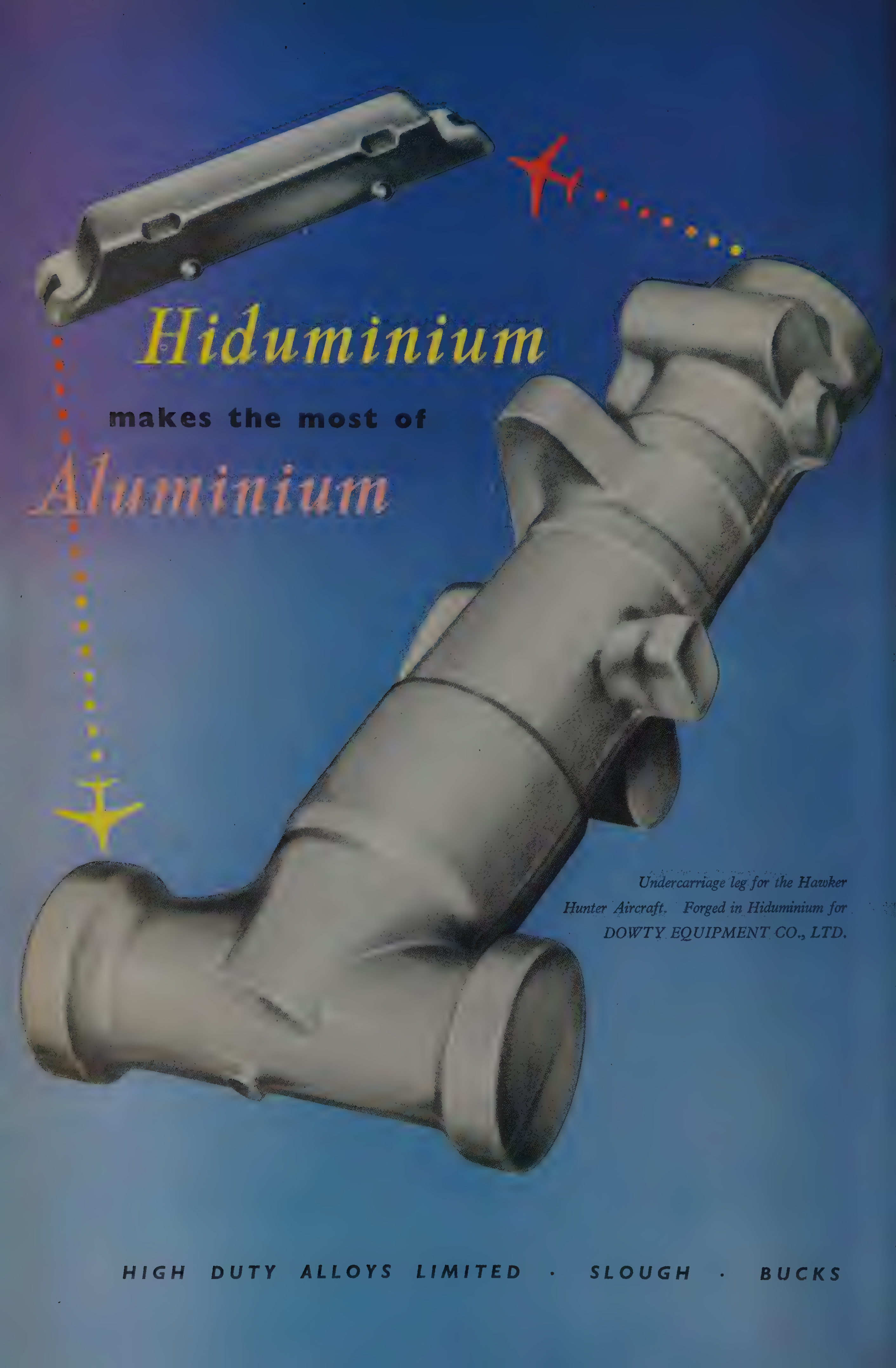
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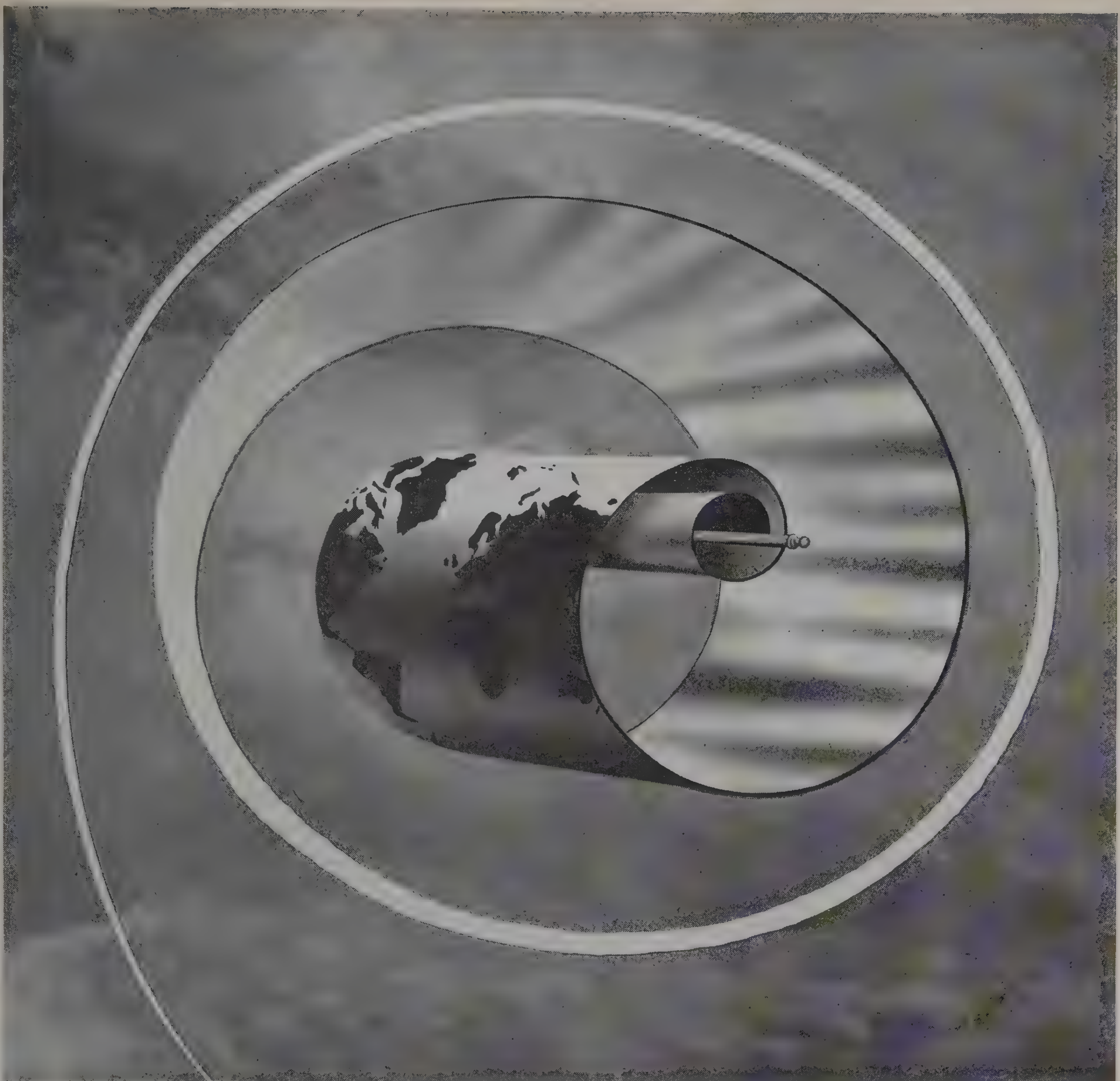

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PREFACE

THE annual revision of "All the World's Aircraft" is a task of the first magnitude. This edition, with 410 pages of text matter, is 30 pages longer than the last and thus reflects the increasing activity of the aircraft industry as a whole.

No major changes in the method of presentation of information have been made. The pages devoted to the National Markings of the World's Air Forces remain essentially as in previous years, although several new markings have been added and others have been modified and brought up-to-date.

The tabulation of the Airlines of the World, which occupies 20 pages, was originally restricted to those airlines operating scheduled services. This year it has been expanded to include non-scheduled operators. The introduction of italic type to distinguish the non-scheduled statistics allows the additional data to be included in a tabular arrangement which differs little from that of previous years.

In 1955 the Fédération Aéronautique Internationale (FAI), a federation of aero clubs and other bodies governing the "sport" of flying World-wide, celebrated its fiftieth birthday, while the two international organisations primarily concerned with civil air transport—the International Civil Aviation Organisation (ICAO), made up of the representatives of 65 nations, and the International Air Transport Association (IATA), representing 72 of the World's scheduled air-carriers—celebrated their tenth anniversaries.

The anniversaries of these three bodies mark important mile-stones in the progress of aviation. The FAI (Jane's is but four years its junior) approved in 1906 the World's first speed record of 25.6 m.p.h. In its fiftieth year it was called upon to homologate the World's first supersonic speed record of 822 m.p.h.

In the ten years of post-war scheduled air transport, that is, in the first ten years of ICAO and IATA, the World's airlines carried 324 million passengers, flew 18,000 million passenger-miles, transported 4,250 million ton-miles of cargo and 1,400 million ton-miles of air mail. The tempo of World air transport now averages a scheduled take-off somewhere in the World every five seconds of the day and night.

These impressive figures have been compiled almost exclusively by piston-engined airliners. The word almost is used advisedly because it was in 1952 that the pioneer jet-powered Comet opened a new era in high-speed transportation. It put in some 30,000 hours of airline flying before it became the victim of an unsuspected manifestation of metal fatigue, the determination of which is one of the most remarkable official investigations ever conducted and was undoubtedly of World-wide importance and value. Also, it was in 1953 that the pioneer turboprop-powered Viscount entered airline service with B.E.A. and has since proved to be a money-maker for several operators. Over 230 Viscounts have been ordered and at the time of writing more than 75 had been delivered.

The United States has accepted the challenge to its piston-engined monopoly with characteristic vigour and in 1955 orders were placed or were contemplated by five of the great U.S. airlines for three U.S. turbine-powered airliners—the Boeing 707 and Douglas DC-8 four-jet airliners and the Lockheed Electra four-turboprop airliner. Only the Boeing 707 exists in a semi-military prototype form ; the others were at the time of writing little beyond the drawing-board or mock-up or tooling-up stage. The earliest delivery date for the Lockheed Electra is given as August, 1958, while first deliveries for the 707 and DC-8 are due in December, 1958 and December, 1959, respectively.

America's entry into the commercial turbine-powered field represents its first break-away from the conventional since the war, and while American "know-how" in the design and construction of commercial aircraft is unique, there still remains the fact that, insofar as operational experience with jet or turboprop is concerned, there is but one American airline, Capital Airlines, which is building up such experience—with Vickers Viscounts.

During the 1954-55 financial year B.E.A.'s fleet of Viscounts flew 6,731,884 aircraft miles in 29,997 hours and produced 34,510,658 capacity ton-miles, 35.1 per cent. of B.E.A.'s total output. An average of 21 Viscounts carried 346,174 passengers for 205,299,508 passenger-miles, together with 4,188 tons of mail and freight, and earned a net profit of over £700,000 at a rate of £23.8 profit for each revenue hour flown, with a break-even load factor of 59.6 per cent. on total costs.

In 1956 B.E.A. will be taking delivery of the first of a fleet of Viscount 800 Series airliners, and at the time of writing was negotiating for a fleet of Vickers 900 Vanguard 93-passenger airliners powered by four 4,400 e.h.p. Rolls-Royce Tyne (RB.109) turboprop engines for delivery in 1959-60. The Vanguard will have built into it all the information and experience accumulated by B.E.A. through the operation of Viscounts, plus all the unique knowledge of turboprop aircraft and engines gained by Vickers and Rolls-Royce since the first Viscounts went into service with B.E.A. in 1953. This pool of engineering and operating experience is without rival in the World.

B.O.A.C. will be putting the Bristol Britannia four turboprop airliner into service in 1956, and a new Comet, the Mark 4, incorporating all the improvements which operating experience and profound technical investigation have called for is being prepared for its re-entry into airline service in 1958.

Lest it be thought that the preceeding remarks are being made in a carping spirit, we would hasten to add that our sole object is to put things in their correct historical perspective and to draw attention to the fact that a new era in air transportation had its beginnings two to three years ago, and that

things have not stood still since then outside the United States.

The section of this book which covers the World's aircraft manufacturers remains as always the largest, totalling 282 pages. It has 724 illustrations, 55 per cent. of which are new. A noteworthy feature of this section is an article on "Guided Missiles" by Dr. Dan A. Kimball. Dr. Kimball, one of the leading authorities on this subject, is President of Aerojet-General Corporation, the largest manufacturers of rocket motors in the World. His important contribution to this volume is necessarily circumscribed by security but it reveals enough to show the astounding progress which has been and is being made in the United States in this particular line of development.

It is undoubtedly the vast amount of research and development which has been undertaken in this field by a large segment of the American industry that has made it possible for the United States Defence Department to announce that work has begun on the World's first space satellite project. "Project Vanguard," a joint Army-Navy-Air Force programme under Navy management, involves the development of a multi-stage rocket launching vehicle, the third or final stage of which will include a small unmanned satellite which will be capable of circling the earth at an altitude of 200 miles once every one or two hours for several days. The Glenn L. Martin Company, one of whose Viking research rockets reached an altitude of 158 miles in 1954, has been awarded a contract for building the rocket-launching vehicle, while General Electric has another important contract for the development of the motor to be used in the first rocket. How near we are to this revolutionary exploration of the upper atmosphere is revealed in the categorical official statement that "the system will be launched sometime during the International Geophysical Year (July, 1957—December, 1958).

Of the total pages of the Aeroplane Section, the American aircraft industry occupies 108 pages with a total of 276 illustrations of which 190, or approximately 70 per cent. are new. The British industry takes up 63 pages with 157 illustrations, and the French industry 33 pages with 91 illustrations.

The American aircraft industry, aided by its share of the gigantic U.S. defence budget, by a healthy home and overseas airliner market, and by the growing business aircraft market, the most rapidly-expanding segment of American civil aviation since the war, has probably reached its greatest production peak in peace-time.

Production is also the keynote with the British industry. The Hunter is now in large-scale service with the Royal Air Force, the first V-bomber squadrons are already armed with the Valiant and the first Vulcan squadron was formed in 1955. In the civil field, the World-wide acceptance of the Vickers Viscount is a success story of the first importance while there is great promise in the Bristol Britannia which is due to go into airline service in 1956. In the smaller feeder line category there are the de Havilland Heron, already in service in ten countries, and the new Handley Page Herald and Scottish Twin Pioneer, both of which flew for the first time in 1955.

The remarkable technical progress which has been made by the French industry, which was well demonstrated at the 1955 Salon de l'Aeronautique, is reflected in the French pages. France is the only European power in N.A.T.O. which is in production with military aircraft of domestic design, while its latest civil designs, notably the Sud-Est Caravelle twin-jet airliner and the Hurel-Dubois H.D.32 and its derivatives, are of great promise. The latter is already in large-scale production.

First signs of a renaissance of a German aircraft industry were seen in 1955. It has been reported that the West German Air Force will probably be equipped with aircraft of Messerschmitt, Heinkel and Dornier design, and that the first aircraft to go into production will be a jet trainer designed by Messerschmitt. What is probably a prototype of this trainer, the HA-200, has been built in Spain by Hispano Aviacion. The first post-war Dornier aircraft, the Do 25, was also built and flown in Spain. Details of both these aircraft will be found in the Spanish aircraft pages.

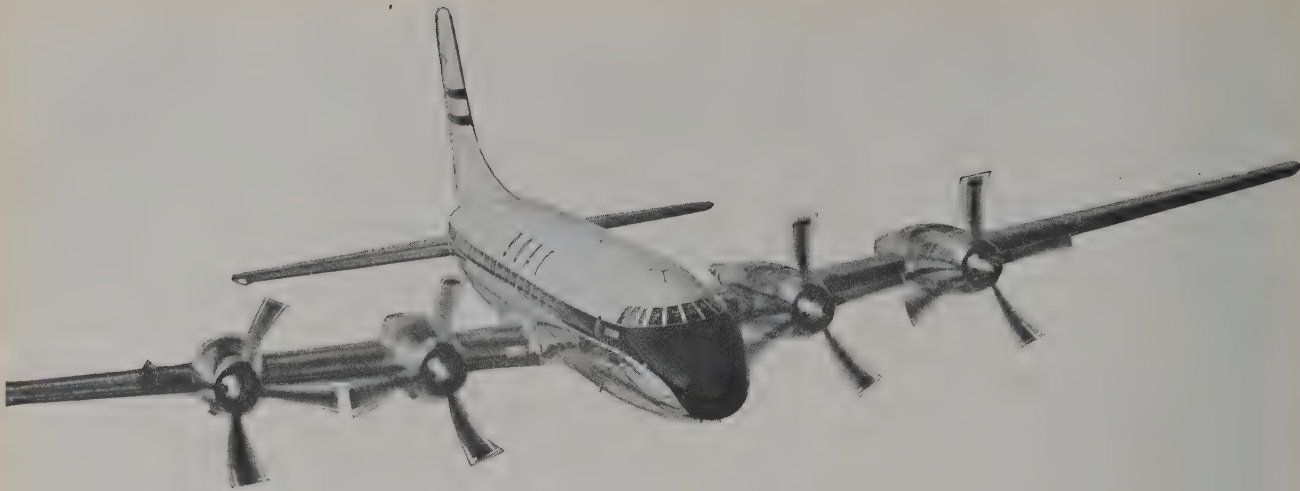
The Engine Section contains a total of 79 pages, of which 46 are devoted to gas turbine power-plants. The Section as a whole contains 141 illustrations, of which 61 are new.

The only service in the World still to make use of airships is the United States Navy, and the sole supplier of to the U.S. Navy is the Goodyear Aircraft Corporation. Details and photographs of the latest Goodyear airships will be found in the three-page Airship Section at the end of the book.

As usual, "All the World's Aircraft" wishes to express its thanks to the technical and public relations officials of the aircraft industries and the airlines of the free World, without whose ready co-operation the task of producing this volume would have been well nigh impossible.

Thanks are also due to several helpers, notably to Mr. Noel Kirkland for his industry in compiling the airline tabulation ; to Mr. L. A. Bradford for his painstaking work in preparing over one hundred new general arrangement drawings and bringing up-to-date many others ; and finally to Mr. Denys Voaden for his valuable co-operation in the compilation of the Russian material in this edition. I am also indebted to Messrs. Warren Bodie, Howard Levy, Harold Martin and Gordon Williams for making available to me photographic material of the highest class for inclusion in the American pages.

L.B.

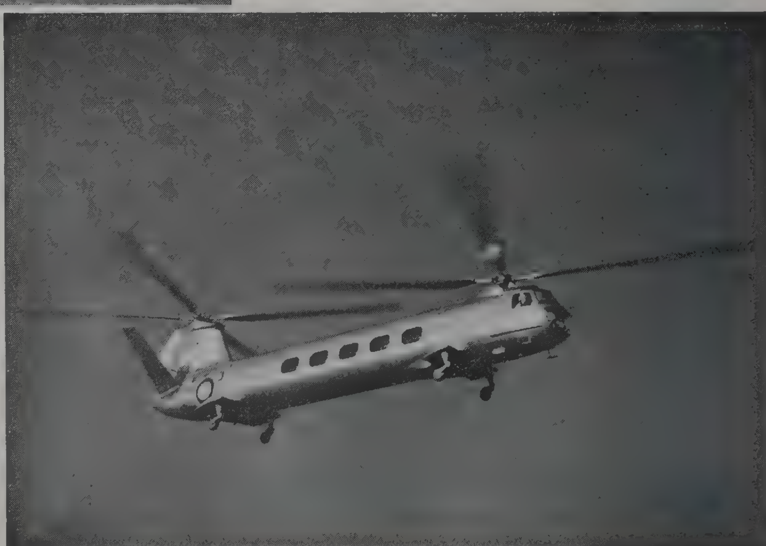


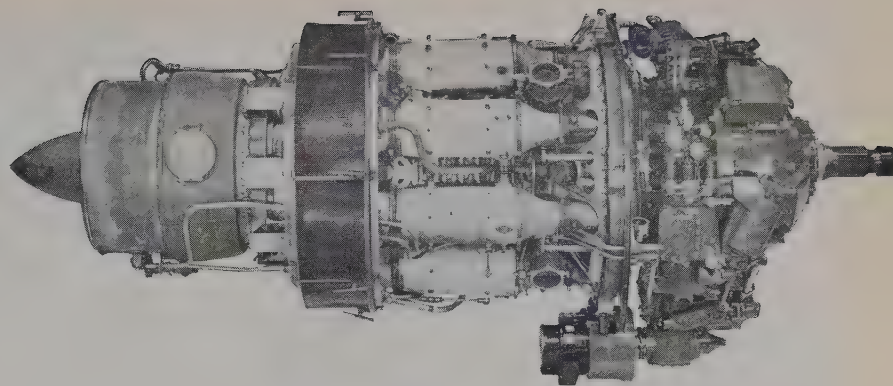
BRISTOL ACTIVITIES

The Bristol Aeroplane Company Limited is the largest single manufacturing unit in the British aircraft industry, and its current activities range over the whole field of aviation. To its varied undertakings Bristol brings the technical knowledge and manufacturing experience acquired during 45 years of progress in aviation engineering.

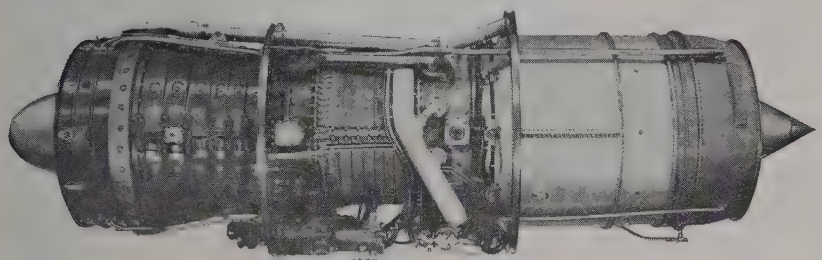
Bristol has played a pioneer role in British development of the helicopter. The Sycamore, for which substantial orders have been placed, is in operation with the Royal Air Force at home and abroad, the British Army, the Royal Australian Navy, the Belgian Air Force, and British European Airways Corporation. Nominally a four-five seat helicopter, the Sycamore is a military vehicle of great versatility, the basic aircraft being provided with all fittings necessary for search/rescue, ambulance, and passenger or freight transport duties. Conversion from one role to another can be swiftly and easily effected.

The Bristol Type 173 was the first twin-engined helicopter in the world capable of safe flight on one engine. It is powered by two Alvis Leonides piston engines. From this prototype design, with which considerable flying experience has been accumulated, are being developed piston and turbine-engined helicopters for the Armed Services. Among the most important of the duties to be undertaken by these helicopters will be the location and destruction of submarines.



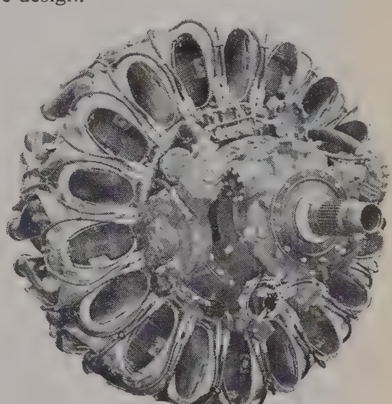


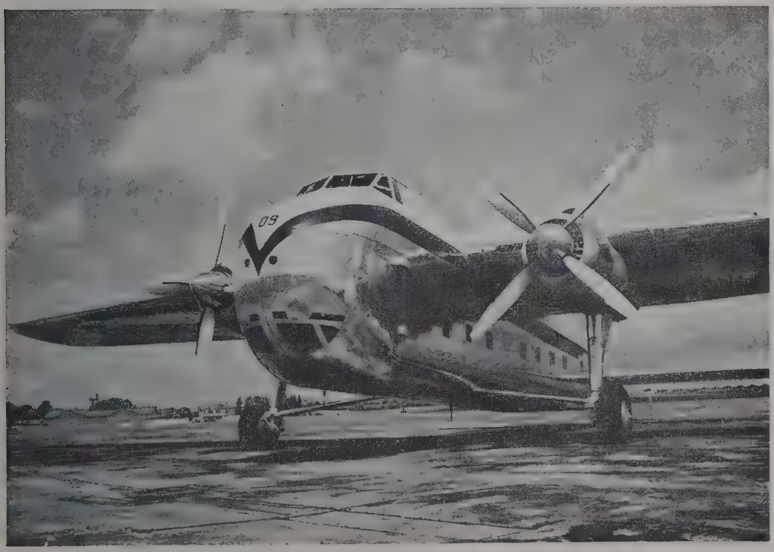
The Britannia 100 airliner is in full production to meet orders from British Overseas Airways Corporation. This airline, the British Government, and El Al Israel Airlines have additionally ordered larger versions of the aircraft, and production is planned to meet a demand foreshadowed by the keen interest of operators in all parts of the world. Designed from the outset for turboprop power, it combines great range and payload with exceptional operating economy. The Bristol Proteus 705, which powers the Britannia 100, is the first large turboprop to be fully approved for commercial operation. The more powerful Proteus 755 (*above*), of 4,120 equivalent horsepower, is being produced for the Britannia 300 and the 300 Long Range, the first aircraft capable of operating a scheduled non-stop transatlantic service from east and west. A maritime reconnaissance version is also being built for the Royal Canadian Air Force by Canadair Limited.



In the Olympus (*left*), officially approved for service at 11,000 lb thrust, and the medium-thrust Orpheus, Bristol has two turbojet engines of outstanding potentiality, between them capable of meeting a variety of military requirements. The exceptional operating economy and high altitude performances of the Olympus—functions of its twin-spool design—make it a formidable power unit for bombers and fighters alike. The Orpheus was designed to meet the growing need for a lightweight, medium-thrust turbojet engine, simple and inexpensive to produce in quantity, to power light fighters and trainers. Its rapid and trouble-free progress through the initial stages of development is indicative of the soundness of its essentially simple design.

Bristol sleeve-valve engines are in service throughout the world, and over 60,000 Hercules (*left*) have been built. The Centaurus (*right*) powers the new Beverley transport now entering service with the Royal Air Force and, in Elizabethan airliners of British European Airways, achieved an inter-overhaul life of 1,250 hours within two years of starting its commercial career.





Over 200 Bristol Type 170 Freighter aircraft (powered by two Hercules engines) have been delivered to civil and military operators in a score of countries. The aircraft's exceptional cargo capacity and the speed of turn-round made possible by the nose-opening doors are vital factors in its success as a general-duty civil and military transport, and have also made possible such specialised services as the car ferries across the English Channel and the Cook Straight freight ferry in New Zealand.

373P

THE NATIONAL MARKINGS OF THE AIR FORCES OF THE WORLD

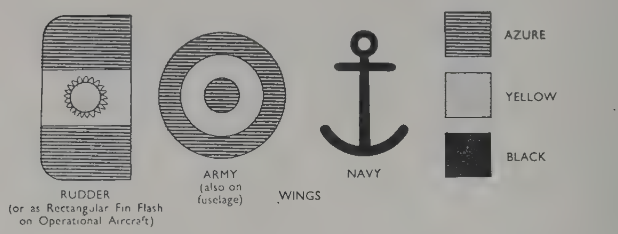
ARRANGED IN

ALPHABETICAL ORDER OF NATIONS

AFGHANISTAN

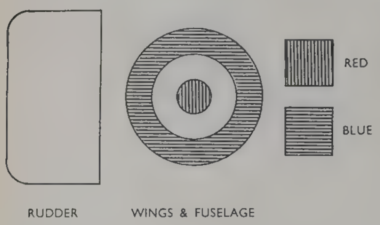
THE ROYAL AFGHAN AIR FORCE

ARGENTINE REPUBLIC



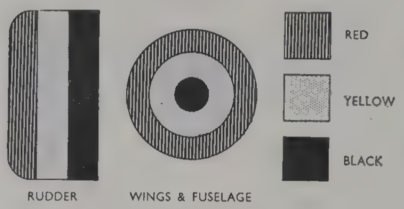
THE ARGENTINE AIR FORCE AND NAVAL AVIATION

AUSTRALIA



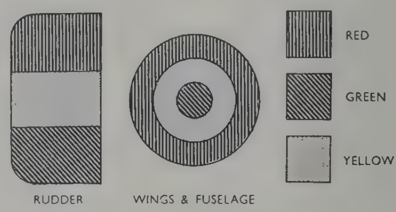
THE ROYAL AUSTRALIAN AIR FORCE

BELGIUM



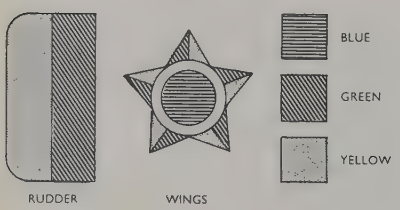
THE ROYAL BELGIAN AIR FORCE

BOLIVIA



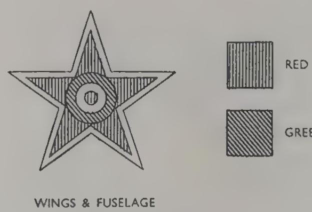
THE BOLIVIAN AIR FORCE

BRAZIL



THE BRAZILIAN AIR FORCE

BULGARIA



THE BULGARIAN AIR FORCE

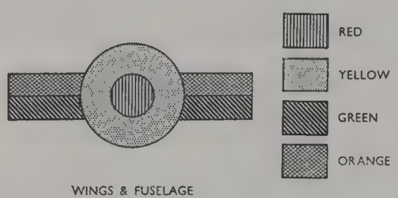
BURMA

THE BURMA AIR FORCE

CANADA

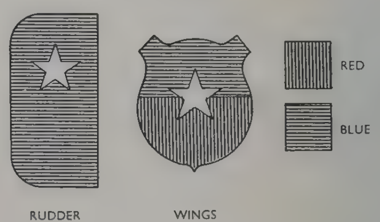
THE ROYAL CANADIAN AIR FORCE
AND NAVAL AVIATION

CEYLON



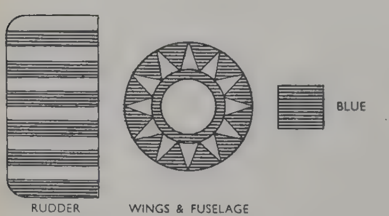
THE ROYAL CEYLON AIR FORCE

CHILE



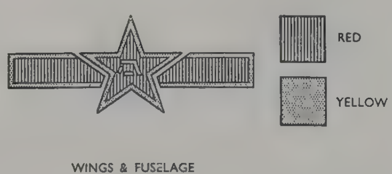
THE CHILEAN AIR FORCE

CHINA
(NATIONALIST)



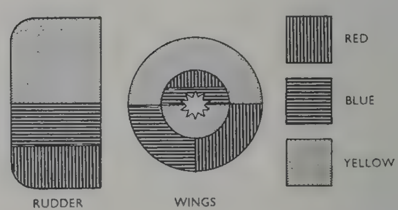
THE CHINESE NATIONALIST AIR FORCE

CHINA
(THE PEOPLE'S REPUBLIC)



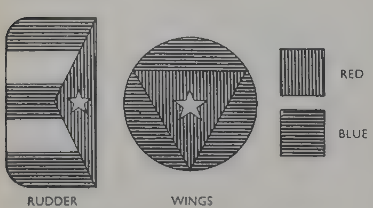
THE CHINESE PEOPLE'S AIR FORCE

COLOMBIA



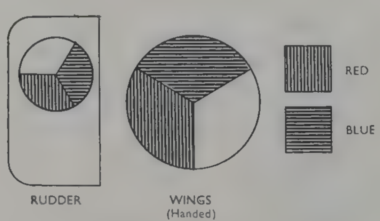
THE COLOMBIAN AIR FORCE

CUBA



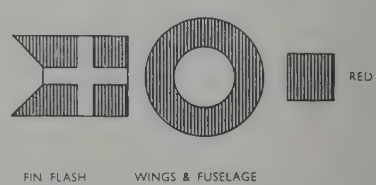
THE CUBAN AIR CORPS

CZECHOSLOVAKIA



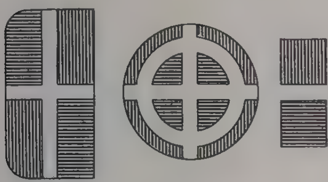
THE CZECHOSLOVAK AIR FORCE

DENMARK



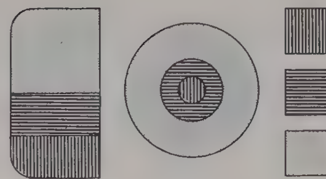
THE ROYAL DANISH AIR FORCE

DOMINICAN REPUBLIC



THE DOMINICAN AIR FORCE

ECUADOR

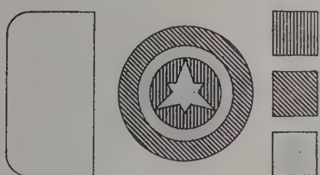


THE ECUADOREAN AIR FORCE

EGYPT

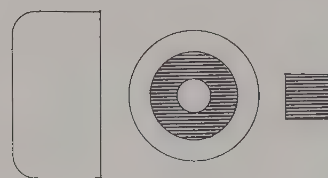
THE EGYPTIAN AIR FORCE

ETHIOPIA



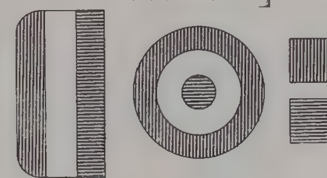
THE IMPERIAL ETHIOPIAN AIR FORCE

FINLAND



THE FINNISH AIR FORCE

FRANCE

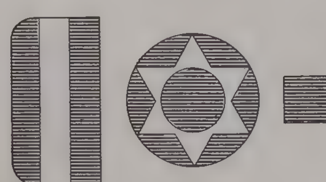


THE FRENCH AIR FORCE
AND NAVAL AVIATION

GREAT BRITAIN

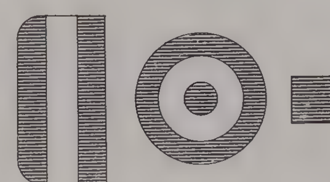
THE ROYAL AIR FORCE
AND FLEET AIR ARM

GUATEMALA



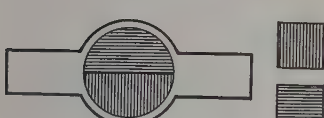
THE GUATEMALAN AIR FORCE

GREECE



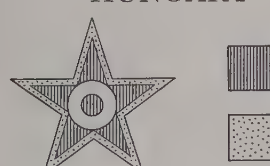
THE ROYAL HELLENIC AIR FORCE

HAITI



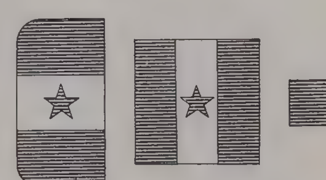
CORPS D'AVIATION D'HAITI

HUNGARY



THE HUNGARIAN AIR FORCE

HONDURAS

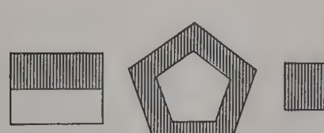


THE HONDURAS MILITARY AIR ARM

INDIA

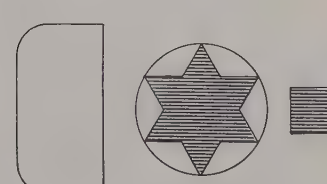
THE INDIAN AIR FORCE

INDONESIA



THE INDONESIAN AIR FORCE

ISRAEL

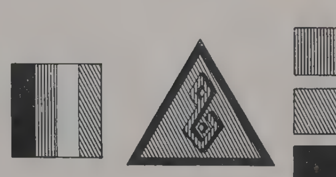


THE ISRAEL AIR FORCE

IRAN

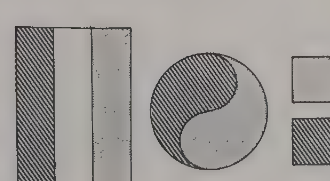
THE IMPERIAL IRANIAN AIR FORCE

IRAQ



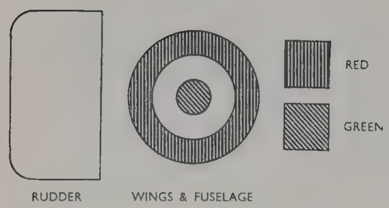
THE ROYAL IRAQI AIR FORCE

IRELAND



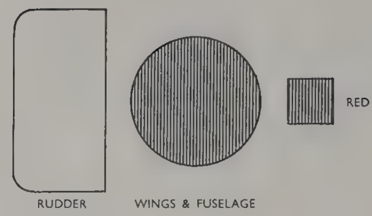
THE IRISH AIR CORPS

ITALY



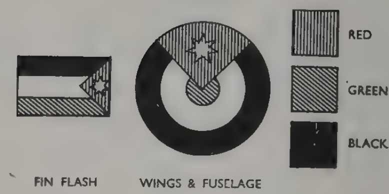
THE ITALIAN AIR FORCE

JAPAN



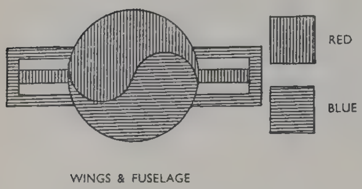
THE JAPANESE DEFENCE FORCES

JORDAN



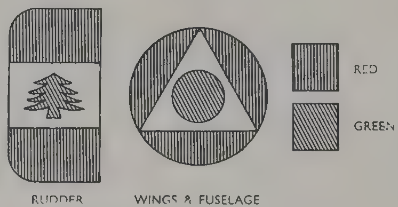
THE ARAB LEGION AIR FORCE

KOREA



THE REPUBLIC OF KOREA AIR FORCE

LEBANON

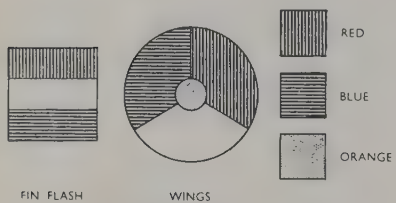


THE LEBANESE AIR FORCE

MEXICO

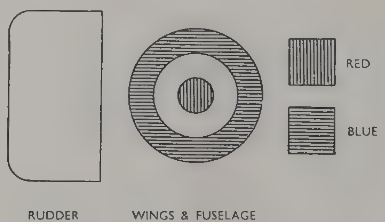
THE MEXICAN AIR FORCE

NETHERLANDS



THE ROYAL NETHERLANDS AIR FORCE

NEW ZEALAND

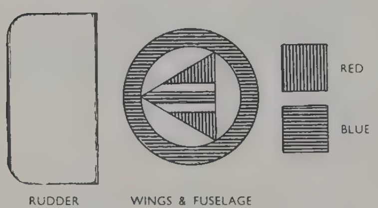


THE ROYAL NEW ZEALAND AIR FORCE

NICARAGUA

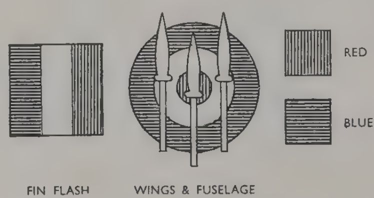
THE NICARAGUAN ARMY AIR FORCE

NORWAY



THE ROYAL NORWEGIAN AIR FORCE

RHODESIA & NYASALAND



THE ROYAL RHODESIAN AIR FORCE

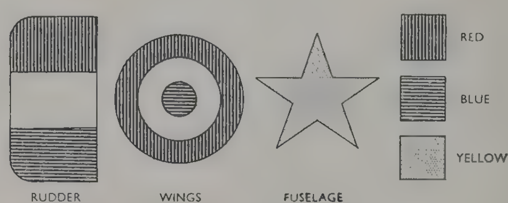
PAKISTAN

THE ROYAL PAKISTAN AIR FORCE

PERU

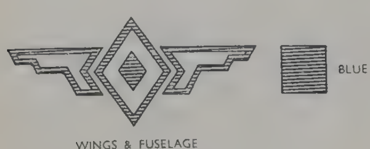
THE PERUVIAN AIR FORCE

PARAGUAY



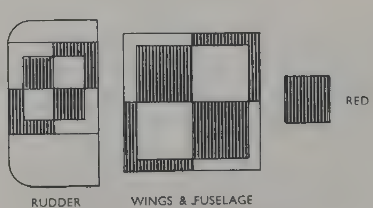
THE PARAGUAYAN AIR FORCE

PHILIPPINE REPUBLIC



THE PHILIPPINE AIR FORCE

POLAND

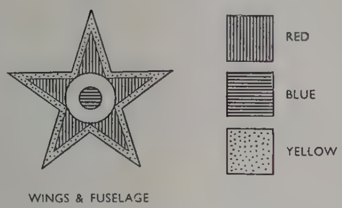


THE POLISH AIR FORCE

PORTUGAL

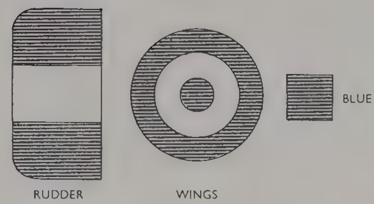
THE PORTUGUESE AIR ARM

RUMANIA



THE RUMANIAN AIR FORCE

SALVADOR

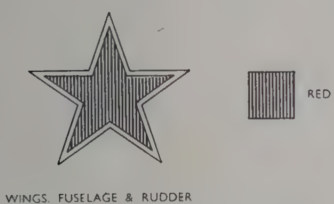


THE MILITARY AIR ARM

SOUTH AFRICA

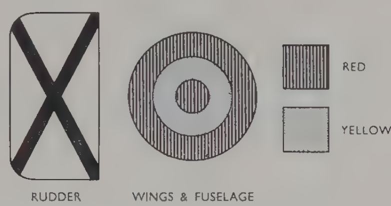
THE SOUTH AFRICAN AIR FORCE

SOVIET UNION



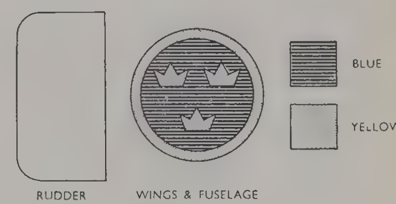
THE RUSSIAN AIR FORCE

SPAIN



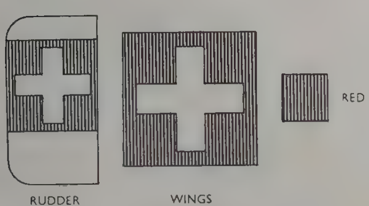
THE SPANISH AIR FORCE

SWEDEN



THE ROYAL SWEDISH AIR FORCE

SWITZERLAND



THE SWISS AIR FORCE

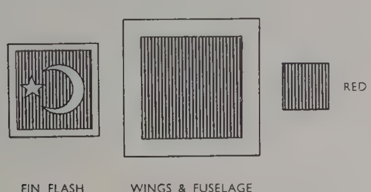
SYRIA

THE SYRIAN AIR FORCE

THAILAND

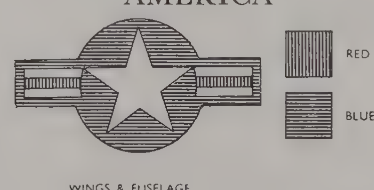
THE ROYAL THAI AIR FORCE

TURKEY



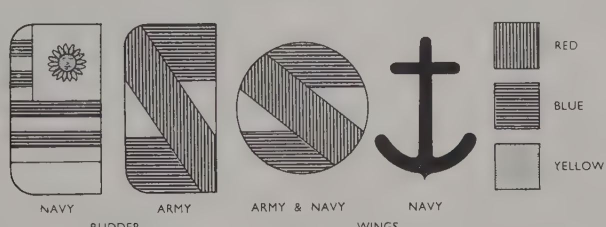
THE TURKISH AIR FORCE

UNITED STATES OF AMERICA



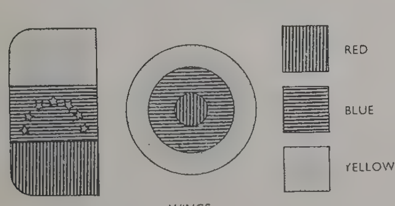
THE UNITED STATES AIR FORCE
AND NAVAL AVIATION

URUGUAY



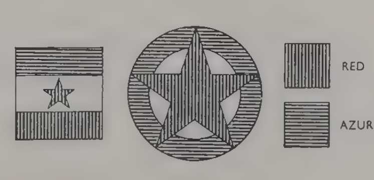
URUGUAYAN MILITARY AND NAVAL AVIATION

VENEZUELA



THE VENEZUELAN AIR FORCES

YUGOSLAVIA



THE YUGOSLAV AIR FORCE

THE WORLD'S CIVIL AVIATION

ARRANGED IN

ALPHABETICAL ORDER OF NATIONS

INCLUDING DETAILS OF THE INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO), THE INTERNATIONAL AIR TRANSPORT ORGANIZATION (IATA), THE FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (FAI), AND OF THE AIRLINES OF THE WORLD

INTERNATIONAL CIVIL AIRCRAFT MARKINGS

AN- Nicaragua.
AP- Pakistan.
B- Formosa.
CB- Bolivia.
CC- Chile.
CCCP-Soviet Union (U.S.S.R.)
CF- Canada.
CR- and **CS-** Portugal and Colonies.
CU- Cuba.
CX- Uruguay.
CZ- Principality of Monaco.
D- Western Germany.
EC- Spain.
EI- and **EJ-** Ireland.
EL- Liberia.
EP- Iran.
ET- Ethiopia.
F- French Union.
G- United Kingdom.
HA- Hungary.
HB- Switzerland.
HC- Ecuador.
HH- Haiti.
HI- Dominican Republic.
HK- Colombia.
HL- Korea
HS- Thailand.
HZ- Saudi Arabia
I- Italy.
JA- Japan.
JY- Jordan.
JZ- Netherlands New Guinea.
LN- Norway.
LV- Argentine Republic.
LX- Luxembourg.
LZ- Bulgaria.
MC- Monte Carlo.
N United States of America.
OB- Peru.
OD- Lebanon.
OE- Austria.
OH- Finland.
OK- Czechoslovakia.
OO- Belgium.
OY- Denmark.
PH- Netherlands.
PI- Philippine Republic.
PJ- Curaçao (Netherlands West Indies).
PK- Indonesia.
PP- and **PT-** Brazil.
PZ- Suriname (Netherlands Guiana).
RX- Republic of Panama.
SE- Sweden.
SN- Sudan.
SP- Poland.
SU- Egypt.
SX- Greece.
TC- Turkey.
TF- Iceland.
TG- Guatemala.
TI- Costa Rica.
VH- Australia.

VP-
VQ- British Colonies and Protectorates as follow :—
VR-

VP-A .. Gold Coast with Ashanti, Northern Territories of Gold Coast in British Togoland.
VP-B .. Bahamas.
VP-F .. Falkland Islands.
VP-G .. British Guiana.
VP-H .. British Honduras.
VP-J .. Jamaica.
VP-K .. Colonies and the Protectorate of Kenya.
VP-L .. Leeward Islands.
VP-M .. Malta.
VP-P .. Islands under the rule of the Western Pacific High Commission.
VP-S .. Protectorate of Somaliland.
VP-T .. Trinidad and Tobago.
VP-U .. Protectorate of Uganda.
VP-V .. St. Vincent.
VP-X .. Colonies and Protectorate of Gambia.
VP-Z .. Protectorate of Zanzibar.
VQ-B .. Barbados.
VQ-C .. Cyprus.
VQ-F .. Fiji Islands.
VQ-G .. Grenada.
VQ-H .. St. Helena.
VQ-L .. St. Lucia.
VQ-M .. Mauritius.
VQ-S .. Seychelle Islands.
VR-A .. Aden.
VR-B .. Bermuda.
VR-G .. Gibraltar.
VR-H .. Hong Kong.
VR-L .. Colonies and Protectorate of Sierra Leone.
VR-N .. Colonies and Protectorate of Nigeria including British Cameroons.
VR-O .. British North Borneo.
VR-R .. Federation of Malaya and Singapore.
VR-T .. Tanganyika.
VR-U .. State of Brunei.
VR-W .. Sarawak.

VT- India.
XA-, **XB-** and **XC-** Mexico.
XH- Honduras.
XT- China.
XY- and **XZ-** Burma.
YA- Afghanistan.
YE- Yemen.
YI- Iraq.
YK- Syria.
YR- Rumania.
YS- El Salvador.
YU- Yugoslavia.
YV- Venezuela.
ZA- Albania.
ZK-, **ZL-** and **ZM-** New Zealand.
ZP- Paraguay.
ZS-, **ZT-** and **ZU-** Union of South Africa.
4R- Ceylon.
4X- Israel.
5A- Libya.

INTERNATIONAL ORGANIZATIONS

THE INTERNATIONAL CIVIL AVIATION ORGANIZATION (I.C.A.O.)

HEADQUARTERS: International Aviation Building, Montreal, Canada.

THE COUNCIL

President: Dr. Edward Warner (U.S.A.).

Member of the Council for the United Kingdom: S. E. Keel,

Secretary General: E. C. R. Ljungberg (Sweden).

Assistant Secretary General for Air Navigation: A. Ferrier (Canada).

Assistant Secretary General for Air Transport: E. M. Weld (U.S.A.).

Director, Bureau of Administration and Services: J. F. Berrier (France).

Director, Legal Bureau: P. K. Roy (India).

Director, Technical Assistance: E. R. Marlin (U.S.A.).

Chief, Public Information: L. C. Boussard (France).

Member States (as at May 1, 1955): Afghanistan, *Argentina, *Australia, Austria, *Belgium, Bolivia, *Brazil, Burma, *Canada, Ceylon, Chile, China, Colombia, Cuba, Czechoslovakia, Denmark, Dominican Republic, Ecuador, *Egypt, El Salvador, Ethiopia, Finland, *France, Greece, Guatemala, Haiti, Honduras, Iceland, *India, Indonesia, Iran, Iraq, *Ireland, Israel, *Italy, Japan, Jordon, Korea, Laos, *Lebanon, Liberia, Libya, Luxembourg, *Mexico, *Netherlands, New Zealand, Nicaragua, *Norway, Pakistan, Paraguay, Peru, *Philippines, Poland, *Portugal, *Spain, Sweden, Switzerland, Syria, Thailand, Turkey, *Union of South Africa, *United Kingdom, *United States, Uruguay, *Venezuela, Viet-Nam.

(*denotes Member of Council).

The International Civil Aviation Organization, successor to the Provisional International Civil Aviation Organization (P.I.C.A.O.), came into being on April 4, 1947, following the ratification of the Permanent Convention by the required number of States.

The Organization consists of an Assembly and a Council.

The Assembly

Meets annually and is convened by the Council. Extraordinary meetings of the Assembly may be held at any time when called by the Council or at the request of any ten member States. All member States have equal right to be represented at the meetings of the Assembly and each member is entitled to one vote. The powers and duties of the Assembly are: (*a*) to elect at each meeting its president and officers; (*b*) to elect the member States to be represented on the Council; (*c*) to examine and take action upon the reports of the Council; (*d*) to determine its own rules of procedure and establish such subsidiary commissions and committees as are needed; approve an annual budget and determine the financial arrangements of the Organization; (*e*) to refer any specific matters to the Council; (*f*) to delegate the necessary powers and authority to the Council which are needed for the duties of the organization; and (*g*) to deal with any matters not specifically assigned to the Council.

The Council

The Council is composed of 21 member States elected by the Assembly for a period of three years, adequate representation being given to: (1) those member States of chief importance in air transport; (2) those member States not otherwise included which make the largest contribution to the provision of facilities for international civil air navigation; (3) those member States not otherwise included whose election will ensure that all major geographical areas of the World are represented. No representative of a member State on the Council may be actively associated with or financially interested in the operation of an international air service.

The Council elects a President, who has no vote. One or more vice-presidents are elected from among the members, and retain the right to vote when serving as acting president. Decisions of the Council are deemed valid when approved by a majority of all members. Any member State not a member of the Council may participate in deliberations whenever any decision is to be taken which especially concerns such a member State, but such a State may not vote. In any case in which there is a dispute between one or more member States not members of the Council and one or more member States who are members of the Council, any State within the second category which is party to the dispute shall have no right to vote on that dispute.

The duties and powers of the Council are:—

(1) to discharge the directives of the Assembly.

(2) to determine its own organization.

(3) to determine the method of appointment, emoluments and conditions of service of the employees of the organization.

(4) to appoint a Secretary-General.

(5) to provide for the establishment of any subsidiary working groups which may be considered desirable, including the following:—

(*a*) A Committee on Air Transport.
(*b*) A Commission on Air Navigation.

(6) to prepare and submit to the Assembly budget estimates of the Organization and statements of accounts of all reports and expenditures.

(7) to enter into agreements with other international bodies when deemed advisable for the maintenance of common service and for common arrangements concerning personnel and, with the approval of the Assembly, enter into such other arrangements as may facilitate the work of the Organization.

In addition, the functions of the Council are to maintain liaison with the member States, calling on them for such data and information as may be required; receive, register and hold open to inspection by member States, all existing contracts and agreements covering routes, services, landing rights, airport facilities, or other international air matters to which any member State or its airlines is a party; supervise and co-ordinate the works of the subsidiary bodies, consider their reports and transmit them and the findings of the Council to the member States. In addition, the Council is to make recommendations on technical matters to the member States of the Assembly, and submit an annual report to the Assembly. When requested by all the parties concerned, the Council will act as an arbitral body on any difference arising among member States relating to international civil aviation matters which may be submitted to it.

The expenses of the Organization are borne by the member States in proportions decided by the Assembly. Each member State bears the expenses of its own delegation to the Assembly and those of its delegates on the Council and its representatives on committees or subsidiary groups.

Each contracting State undertakes that its international airlines shall file traffic reports, cost statistics and financial states with the Council. Each contracting State may designate the route to be followed within its territory by any international air service, and the airports which any such service may use. If the Council is of the opinion that the airports or other navigation facilities of a contracting State are not reasonably adequate the Council may consult with the State and others affected, to find means of correcting the position and may make recommendations. If requested by the State, the Council may provide all or a portion of the costs needed for the remedies.

A contracting State may at any time discharge any obligation into which it has entered and take over airports and other facilities which the Council has established in its territory by paying to the Council an amount considered reasonable.

The Council may suggest to contracting States that they form joint organizations to operate air services on any routes or in any regions.

The duties of the subsidiary bodies established under the Council shall be:—

Air Transport. To observe, correlate and report continually on facts concerning the origin and volume of international air traffic and the relation of such traffic, or the demand for it, to the facilities provided; collect, analyse and report on subsidies, tariffs and costs of operation; study matters affecting the organization and operation of international air services, including the international ownership and operation of international trunk lines; and study and report, with recommendations, to the Assembly on matters on which agreement was not reached at the Chicago International Civil Aviation Conference.

Air Navigation. To study and advise the Council on standards and procedures for communications systems and air navigation aids including rules of the air, traffic control practices, licensing of operating and mechanical personnel, airworthiness, registration and identification of aircraft, meteorological protection of international aeronautics, log books, maps and charts, airports, customs, accident investigation and so forth. In addition it will work towards the adoption of minimum requirements and standard procedures for all the above and continue the preparation of technical documents in accordance with the recommendations of the Chicago Conference.

THE INTERNATIONAL AIR TRANSPORT ASSOCIATION (I.A.T.A.)

HEAD OFFICE: International Aviation Building, Montreal 3, P.Q., Canada.

BRANCH OFFICES: 30, Curzon Street, W.1, London (I.A.T.A. Clearing House, I.A.T.A. European Technical Liaison Office); 500, Fifth Avenue, New York 36 (I.A.T.A. Traffic Conference No. 1, I.A.T.A. Enforcement Office); 76-78, Champs Elysées, Paris (VIII) (I.A.T.A. Traffic Conference No. 2); MacDonald House, Singapore, F.M.S. (I.A.T.A. Traffic Conference No. 3).

President: (1954-55) Max Hymans (Air France).

President-elect: (1955-56) Juan T. Trippe (Pan American World Airways).

Director General: Sir William P. Hildred.

Treasurer: Dr. H. J. Gorecki.

Traffic Director: John Brancker.

Legal Adviser: Prof. John C. Cooper.

Secretary: A. Laurence Young.

Executive Committee: Dr. Walter Berchtold (Swissair); René Briend (Air

France); Lord Douglas of Kirtleside (British European Airways); Sir Wilmot Hudson Fysh (Qantas Empire Airways); Croil Hunter (Northwest Airlines); Sir Leonard M. Isitt (Tasman Empire Airways); John C. Leslie (Pan American World Airways); Major J. Ronald McCrindle (B.O.A.C.); Gordon R. McGregor (Trans-Canada Airlines); Per A. Norlin (S.A.S.); Gregorio Obregon P (Aerovias Nacionales de Colombia); Prince Pacelli (Linee Aeree Italiane S.p.A.); Gilbert Périer (SABENA); Warren Lee Pierson (Trans World Airlines); Dr. Paulo Sampaio (Panair do Brasil); J. R. D. Tata (Air India International); General C. J. Venter (South African Airways); Dr. Felix von Ballusek (KLM).

Financial Committee: V. J. Long (A.A.), Chairman; Dr. H. J. Gorecki, Secretary.

Legal Committee: René Golstien (SABENA), Chairman; J. G. Gazdik, Secretary.

Medical Committee: Sir Harold Whittingham (B.O.A.C.), Chairman; A. M. Black, Secretary.

Technical Committee: Raymond Dupré (Air France), Chairman; Stanislaw Krzyczkowski, Secretary.

Traffic Advisory Committee: John Brancker, Chairman pro tem.

Chief Enforcement Officer: R. Feick.

Economics and Statistics Officer: Harold E. Shenton.

Legal Drafting Officer: W. M. Sheehan.

Public Relations Officer: S. Ralph Cohen.

Facilitation Officer: C. W. R. Vallance.

Manager of London Clearing House: A. J. Quin-Harkin.

European Technical Liaison Officer: Stanislav Krejcik.

Traffic Conference Secretaries: V. de Boursac (Paris); E. S. Pefanis (New York); R. A. McGowan (Singapore).

The International Air Transport Association was formally inaugurated on April 19, 1945, at Havana, following a conference of international airline operators. Invitations to the conference and plans for the new organization were drawn up at a conference held in Chicago in December, 1944, on the initiative of the American Air Transport Association and attended by 34 representatives of 21 nations. The new Association succeeds the original International Air Traffic Association founded in 1919.

Headquarters of I.A.T.A. are at Montreal, Canada, and the association consists of a General Assembly and an Executive Committee, in which is vested the management of the association. The post of President is honorary.

The aims and objects of I.A.T.A. are to promote safe, regular and economical air transport; to foster the development of air commerce, and to study all problems connected therewith; to provide efficient machinery for collaboration among all air transport operators who are engaged directly or indirectly in international air transport service; and to co-operate with the International Civil Aviation Organization (I.C.A.O.) and other international bodies.

There are two categories of membership—Active and Associate. Any air transport enterprise is eligible for active membership if it operates a scheduled air service under proper authority for the carriage of passengers, mail or cargo, between the territories of two or more States, under the flag of a State eligible to membership in the International Civil Aviation Organisation.

The Active Members are at July 1, 1955:—*Aer Lingus Teoranta (Dublin); Aerolineas Argentinas (Buenos Aires); Aerolinee Italiane Internazionali (ALITALIA) (Rome); Aero O/Y (Helsinki); *Aerovias Nacionales de Colombia (AVIANCA) (Bogota); *Aigle Azur (Paris); Air Algérie (Algiers); *Air Ceylon Ltd. (Colombo); *Air France (Paris); *Air India International (Bombay); Air Liban (Beirut); *Air Vietnam (Saigon); *Airwork Ltd. (London); *American Airlines Inc. (New York); Aviacion y Comercio, S.A. (Madrid); †Braniff Airways Inc. (Dallas); *British European Airways (London); *British Overseas Airways Corporation (London); *Canadian Pacific Air Lines, Ltd. (Vancouver); *Central African Airways Corporation (Salisbury, Southern Rhodesia); *Ceskoslovenske Aerolinie, N.P. (Prague); †Colonial Airlines Inc. (New York); †Compania Cubana de Aviacion (CUBANA) (Havana); *Compagnie de Transports Aériens Intercontinentaux (TAI) (Paris); *Cyprus Airways Ltd. (Nicosia); †Delta-C. & S. Air Lines Inc. (Atlanta); *Deutsche Lufthansa (Cologne); Divisão de Exploração dos Transportes Aereos (DETA) (Lourenço Marques); Divisão de Exploração dos Transportes Aereos (DTA) (Luanda); East African Airways Corporation (Nairobi); El Al, Israel Airlines Ltd. (Tel Aviv); Empresa de Viação Aerea Rio Grandense (VARIG) (Porto Alegre); *Flugfelag Islands H.F. (Reykjavik); *Garuda Indonesian Airways N.V. (Djakarta); *Guest Aerovias Mexico, S.A. (Mexico City); *Hunting-Clan Air Transport Ltd. (London); IBERIA, Compania Mercantil Anonima de Lineas Aereas Espanolas (Madrid); *Iraqi Airways (Baghdad); *Japan Air Lines Company, Ltd. (Tokyo); *Jugoslovenski Aerotransport (JAT) (Belgrade); *KLM Royal Dutch Airlines (The Hague); Linea Aerea Nacional (LAN) (Santiago, Chile); Linea Aeropostal Venezolana (Caracas); Linee Aeree Italiane, S.P.A. (Rome); *Malayan Airways Ltd. (Singapore); Misrair, S.A.E. (Cairo); †National Airlines Inc. (Miami); *National Greek Airlines (TAE) (Athens); *New Zealand National Airways Corporation (Wellington); *Northwest Airlines Inc. (St. Paul); *Pakistan International Airlines (Karachi); *Panair do Brasil, S.A. (Rio de Janeiro); *Pan-American Grace Airways Inc. (New York); *Pan-American World Airways Inc. (New York); *Philippine Air Lines, Inc. (Manila); Polish State Airlines (LOT) (Warsaw); *Qantas Empire Airways, Ltd. (Sydney); *Scandinavian Airlines System (Stockholm); Servicos Aereos Cruzeiro do Sul, Ltda. (Rio de Janeiro); *Société Anonyme Belge d'Exploitation de la Navigation Aerienne (SABENA) (Brussels); *South African Airways (Johannesburg); *Swiss Air Transport Co. Ltd. (Zurich); *Tasman Empire Airways Ltd. (Auckland); *Trans Canada Air Lines (Montreal); Transportes Aereos Portugueses (TAP) (Lisbon); *Trans World Airlines, Inc. (New York); *Union Aéromaritime de Transport (UAT) (Paris); †United Air Lines (Chicago); *West African Airways Corporation (Lagos);

(* Member of I.A.T.A. Clearing House).

(† Clears via Airlines Clearing House).

Associate membership may be obtained by any air transport concern operating an authorised scheduled air service under the flag of a State eligible for membership in the International Civil Aviation Organization. The Associate Member companies are:—*Australian National Airways Pty. (Melbourne); †Eastern Airlines, Inc. (New York); †New York Airways Inc. (New York); *Trans-Australia Airlines (Melbourne).

The creative work of I.A.T.A. is done largely by five Standing Committees—Financial, Legal, Medical, Technical and Traffic Advisory. Their affairs are administered by I.A.T.A.'s small secretariat who provide services for them and carry forward their recommendations. Rules for the conduct of the committees are laid down, and their decisions subject to final approval by the Executive Committee.

The Financial Committee has in its purview all financial matters connected with air transport; standardization of methods of rendering; verifying and settling accounts for revenue transactions between members; aeronautical insurance matters; introduction and control of money documents; and statistical matters. An important step was the creation of the I.A.T.A. Clearing House, whose operations provide for the airlines an approach to an international currency. Set up to handle the inter-company revenue transactions of I.A.T.A. members, the Clearing House offsets their balances on a monthly basis and consolidates the result into a single monthly statement to each. Besides eliminating exchange risks and the costs involved in the ordinary settlement of these accounts the Clearing House makes it possible for its members to do business in both sterling and dollars.

An agreement was reached in May, 1948, for inter-clearance between I.A.T.A. and the Airlines Clearing House, Chicago. This arrangement between the two clearing houses enables the North American operators to accept bookings from soft currency areas, as well as from those countries which can pay in dollars, and to exchange business under the terms of the Universal Air Travel Plan.

The Legal Committee deals generally with legal matters having a bearing on international air transport, particularly with international conventions on public and private air law and on other means of transport; with conflicts of law and with arbitration.

The Medical Committee has within its purview the physiological and psychological aspects of flight as they affect passengers and aircrew; international sanitary regulations, etc.

The Technical Committee concerns itself with all international operational and engineering matters; promotion of safety and efficiency in flight; standardization of equipment and consumable spares; unification of procedures; radio and electronics; meteorology; maintenance of aircraft; airways and ground aids. Once a year, the personnel of the Technical Committee and its various working groups hold a Technical Conference, in which the airlines of the world exchange technical information and recommend technical policy on an international basis. Government agencies, manufacturers, research establishments and other international organizations also participate in these Conferences,

I.A.T.A.'s technical branch has achieved a large measure of unification of operating practices as between the airlines themselves. An exchange of vital information about the causes of accidents and near accidents, as well as about other practical matters, is fruitfully carried on. I.A.T.A. technical delegations have also played a part in working out the allocation of frequencies for communications purposes voted by the International Telecommunications Union Conference, and have co-operated also with the International Meteorological Organization and others.

Under the heading of Traffic, I.A.T.A. is concerned with all matters involving passengers, cargo and the handling of mail. It continually studies tariffs and schedules; general conditions of carriage; all matters pertaining to agents; and the forms, documents and procedures used by the airlines themselves or required of them and their customers by governments. Traffic work is co-ordinated by the Traffic Director and the Traffic Advisory Committee and the Association's studies represent the best opinion of the whole industry, arrived at from the point of view of the worldwide air transport network.

Applying many of these recommendations to day-to-day operations over the

whole world and under highly variable conditions, is a complicated and delicate task. The final recommendations on rates and tariffs, conditions of carriage and agency matters are therefore left to Conferences, made up of the companies concerned actually providing service in any of the three following regions: I—North and South America, Greenland and the Hawaiian Islands; II—Europe, Africa and the Middle East, including Iran; and III—Asia, Australasia and the islands of the Pacific.

Within their terms of reference, the Traffic Conferences are autonomous. Their resolutions must be passed unanimously, and because of the high degree of public interest involved, they are subject to the approval of a number of governments.

This public concern applies particularly to the matters of rates and fares; many governments have, by international agreement or national law, recognized the Conferences as agencies by which their various economic interests in international air transport can be fairly adjusted,

In traffic procedures and practices, the I.A,T.A. Traffic Conferences have achieved a degree of worldwide uniformity unprecedented in the history of transport. Since the first worldwide joint Traffic Conference meetings at Rio de Janeiro, in October, 1947, I.A.T.A. has achieved the adoption of worldwide uniform tickets, air waybills, consignment notes and other documents; flight-line numbers and airline designators; conditions of contract and agency agreements and resolutions; as well as the development of a worldwide rate structure. Most recent achievements include the extension of the interline agreements and the services of more than 100 carriers throughout the World; the adoption of the first uniform Worldwide conditions of carriage in the history of transportation; and of a uniform restricted articles code applicable on a Worldwide basis to cargo. The three Conferences now meet in Composite session.

A basic part of the work of I.A.T.A. is daily co-operation with I.C.A.O. in the drafting of the latter organization's Standards and Recommended Practices, which set an international pattern for national technical regulation of aviation. Experts of I.A.T.A. member airlines and members of the I.A.T.A. Secretariat participate in all regional and divisional meetings of I.C.A.O., making available to the government organization the practical operating knowledge of the airlines. This technical work has been both intensive and extensive, covering all phases of technical operations and concerning itself with a multitude of details.

I.A.T.A. maintains close contact with I.C.A.O. in many other fields. Both organizations are vitally concerned in the campaign to facilitate international commerce by air, and I.A.T.A. has formed regional committees of airline operators to encourage government adoption of the I.C.A.O. Facilitation Standards.

Other organizations with whom I.A.T.A. maintains close working liaison include the Universal Postal Union, International Telecommunications Union, and other organizations in the fields in which air transport is interested.

I.A.T.A. has been commissioned by its members to issue certain publications on their behalf. Among these, the following are available to the interested public and may be ordered from the Head Office at Montreal:—

I.A.T.A. Bulletin. Published twice a year as the official record of the proceedings of the Association. $3.75 (U.S.) per year, $2.00 (U.S.) for the separate number.

Selecciones del Boletin de la I.A.T.A. Published annually in Spanish to make available in that language the principal contents of the English Bulletins.

Tabulation of Great Circle Distances. $5.00 (U.S.) per year, including 12 months' revision service.

Universal Interline Reservations Code. Given publication through various air guides.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (F.A.I.)

HEAD OFFICE: 6, RUE GALILÉE, PARIS, FRANCE.

President: Captain K. J. G. Bartlett, C.B.E. (Great Britain).

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The *Fédération Áéronautique Internationale* was founded in Paris, in October, 1905. The countries represented at its foundation were Belgium, France, Germany, Great Britain, Italy, Spain, Switzerland, and the United States of America. The aim was co-operation between nations concerning aeronautics and with the development of aviation the F.A.I. has become the international representative body of world private aviation. The first record to be officially homologated by the F.A.I. was a speed record of 41.29 km.h. (25.06 m.p.h.) set up on November 12, 1906 by Alberto Santos Dumont. He was timed over a distance of 220 metres (721 feet), which was as far as he could then fly.

Before and between the two wars many international arrangements were made under the supervision of the F.A.I. and international rules and sports codes for private flying were drawn up. Most of the countries which were represented on the F.A.I. through their accredited national Aero Clubs have agreed to recognise the *Carnet de passages en Douane* making private flying between countries easier. Landing facilities and international sport and touring licences were introduced. The F.A.I. also played an important *rôle* in the development of gliding, soaring and model aircraft flying.

All World or National Records must be observed by a representative of a national Aero Club affiliated to the F.A.I. before such a record is homologated or approved by the F.A.I.

The F.A.I., through its *Commission Internationale de l'Aviation Legère et du Tourisme Aérien* (C.I.A.L.T.A.) maintains the closest co-operation with I.C.A.O. through a liaison officer in Montreal.

The F.A.I. sits annually in general conference, but its various commissions sit more often.

The following is the list of national Aero Clubs, Federations or Associations which are affiliated to the F.A.I. (correct at June 1st, 1955):—

Argentina. Aero-Club Argentino, Rodriguez Pena 240, Buenos Aires.

Australia. The Aero Club Federation of Australia, 108 Queen Street, Melbourne.

Austria. Oesterreichischer Aero-Club, Dominikaner Bastei 24, Vienna.

Belgium. Aero-Club Royal de Belgique, 53 Avenue des Arts, Brussels.

Bolivia. Aero-Club Boliviano, Casilla 1569, La Paz.

Brazil. Aero-Club do Brasil, Av. Brasil s/n Manguinhos, Rio de Janeiro.

Canada. The Royal Canadian Flying Clubs Association, 309 Journal Buildings, Ottawa.

Chile. Federacion Aeronautica de Chile, Huérfanos 1147, Officina 642, Santiago du Chile.

Colombia. Aero-Club de Colombia, Edificio Narino, Avenida Jimenez de Quesada 11-28, Bogota.

Cuba. Club de Aviacion de Cuba, Edificio Larrea 206, Aguiar y empedrado, Havana.

Czechoslovakia. Aeroklub Republiky Ceskoslovenské, Smecky 22, Prague.

Denmark. Kongelig Dansk Aeroklub, Osterbrogade 40, Copenhagen.

Ecuador. Aero-Club del Ecuador, Casilla 348, Guayaquil.

Egypt. Aéro-Club d'Egypte, 26 rue Cherif Pacha, Cairo.

Finland. Suomen Ilmailuliitto, Mannerheimintie 16, Helsinki.

France. Aéro-Club de France, 6 rue Galilée, Paris.

German Federal Republic. Deutscher Aero-Club e V., Taunusanlage 20, Frankfurt-am-Main.

Great Britain. The Royal Aero Club of the United Kingdom, 119 Piccadilly, London, W.1.

Greece. Royal Aero Club of Greece, 35 Jan Smuts Street, Athens.

Hungary. Magyar Repulyo Szovetseg, Engels ter 14, Budapest V.

Iceland. Flugmalafelag Islands, Reykjavik Airport, Reykjavik.

India. Aero Club of India, P.O. Box No. 68, New Delhi.

Ireland. Irish Aviation Club, Dublin Airport, Dublin.

Israel. The Aero Club of Israel, 9 Montefiore Street, P.O.B. 1311, Tel Aviv.

Italy. Aero-Club d'Italia, via Cesare Beccaria 35, Rome.

Japan. Nippon Koku Kyokai, Hikokan (Aviation) Building, 1-3 Tamura-Cho, Minato-Ku, Yokyo.

Luxemburg. Aéro-Club du Grand-Duché de Luxembourg, 5 Avenue Monterey, Luxembourg.

Mexico. Club Aereo de Mexico, Aeropuerto Central, Mexico D.F.

Monaco. Aero-Club de Monaco, 8 rue Grimaldi, Monaco.

Netherlands. Koninklijke Nederlandse Vereniging Voor Luchtvaart, 3 Anna Poulownaplein, The Hague.

New Zealand. Royal New Zealand Aero Club, 39 Johnston Street, Wellington C.

Norway. Norsk Aero-Klubb, ovre Vollgate 7, Oslo.

Peru. Aero-Club del Peru, Baquijano 722, Lima.

Poland. Aeroklub Rzeczypospolitej Polskiej, Ul Dluga 52, Warsaw.

Portugal. Aéro-Club de Portugal, Avenida da Liberdade 226, Lisbon.

Saar. Aero Club Saar, Elsasserstrasse 2, Sarrbrücken.
South Africa. The Aero Club of South Africa, P.O. Box 2312, Johannesburg.
Soviet Union. Aero-Club Central de l'U.S.S.R., V.P. Tchkalov, Moscow—Touchino.
Spain. Real Aero-Club de Espana, Carrera de San Jeronimo 19, Madrid.
Sweden. Kungl. Svenska Aeroklubben, Malmskillnadsgaten 27, Stockholm.
Switzerland. Aero-Club de Suisse, Hirschengraben 22, Zurich.
Turkey. Turk Hava Kurumu, Enstitü Caddesi 1, Ankara.
United States. National Aeronautic Association of U.S.A., 1025 Connecticut Avenue, Washington D.C.
Uruguay. Aero-Club del Uruguay, Paysandu 896, Montevideo.

Venezuela. Federacion Venezolana de Aeronautica, Apartado 3942, Edificio Ayacucho, Conde a Padre Sierra, Caracas.

Yugoslavia. Vazduhoplovni Savez Jugoslavije, Uzun Mirkova 4/1, Belgrade.

WORLD'S RECORDS

Homologated by the Fédération Aéronautique Internationale.

ABSOLUTE RECORDS IRRESPECTIVE OF CLASS

Speed (U.S.A.).
Lieut. Col. Frank K. Everest, Jr., U.S.A.F. in a North American YF-100A, Salton Sea, California. October 29, 1953. 1,215.298 km.h. (755.15 m.p.h.).

Altitude (U.S.A.).
Capt. O. A. Anderson and Capt. A. W. Stevens in the balloon "Explorer II." November 11, 1935. 22,066 m. (72,395 ft.).

Distance in Straight Line (U.S.A.).
Cdr. T. D. Davies, Cdr. E. P. Rankin, Cdr. S. Reid, Lieut. Cdr. R. A. Tabeling, U.S.N. in a Lockheed P2V-1. Perth, Australia, to Columbus, Ohio, U.S.A. September 29-October 1, 1946. 18,081.990 km. (11,235.6 miles).

Distance in Closed Circuit (U.S.A.).
Lieut. Col. Lassiter and Capt. W. J. Valentine, U.S.A.F. in a Boeing B-29. August 1-3, 1947. 14,249.656 km. (8,854 miles).

RECORDS BY CLASS

The following Classes are recognised by the F.A.I. for record purposes :—Class A (Spherical Balloons), Class B (Dirigibles), Class C (Powered Aircraft), Class D (Motorless Aircraft) and Class E (Rotary-wing Aircraft). Listed below are the principal records for Speed, Altitude and Distance in Classes C, D and E. Classes A and B, for which no records have been claimed since 1941, are not included.

CLASS C (POWERED AIRCRAFT).

1—*Aircraft fitted with piston engines.*

Speed (Germany).
Fritz Wendel in a Messerschmitt Bf 109R. Augsberg. April 26, 1939. 755.138 km.h. (469.2 m.p.h.).

Altitude (Italy).
Mario Pezzi in a Caproni 161*bis*. Montecelio. October 22, 1938. 17,083 m. (56,046.5 ft.).

Distance in Straight Line (U.S.A.).
As Absolute Record (see prev. col.)

2—*Aircraft fitted with jet engines.*

Speed (U.S.A.).
As Absolute Record (see prev. col.)

Altitude (Great Britain).
Wing Cdr. W. F. Gibb in an English Electric Canberra (two Bristol Olympus turbojets). Filton, Bristol. May 4, 1953. 19,406 m. (63,668 ft.).

CLASS C*bis* (SEAPLANES.)

Speed (Italy).
Francesco Agello in a Macchi M.C. 72 seaplane. Descenzano. October 23, 1934. 709.209 km.h. (440.68 m.p.h.).

Altitude (Italy).
Lieut. Col. N. di Mauro in a Caproni 161*bis* seaplane. Vigna di Valle. September 25, 1939. 13,542 m. (44,429 ft.).

Distance in Straight Line (Great Britain).
Capt. D. C. T. Bennett and 1st Officer I. Hervey in Short-Mayo "Mercury" seaplane (composite launch). Dundee, Scotland, to Port Nolloth, South Africa. October 6-8, 1938. 9,652 km. (5,997.5 miles).

CLASS D (MOTORLESS AIRCRAFT).

1—*Single-seat sailplanes.*

Duration (France).
Charles Atger in an Arsenal Air-100. Romanin les Alpilles. April 2-4, 1952. 56 hours, 15 minutes.

Distance in Straight Line (U.S.A.).
Richard H. Johnson in a Ross-Johnson. From Odessa, Texas, to Salina, Kansas. August 5, 1951. 861.272 km. (535.19 miles).

Absolute Height (U.S.A.).
W. S. Ivans, Jr. in a Schweizer SGS 1-23. Bishop, California. December 30, 1950. 12,832 m. (42,099.6 ft.).

2—*Multi-seat sailplanes.*

Duration (France).
Dauvin and Couston in a Castel-Mauboussin C.M.7. Romanin les Alpilles, April 6-8, 1954. 57 hours, 10 minutes.

Distance in a Straight Line (U.S.S.R.).
Victor Htchenko and G, Petchnikov in an A.10 sailplane from Kountsevo to Hovlia, May 26, 1953. 829.822 km. (515. 626 miles),

Absolute Height (U.S.A.).
Lawrence E. Edgar and Harold E. Klieforth in Pratt-Read G.1. Bishop, Cal. March 19, 1952. 13,489 m. (44,255 ft.).

CLASS E (ROTARY-WING AIRCRAFT).

Distance in Straight Line (U.S.A.).
Elton J. Smith in a Bell 47D1. Fort Worth, Texas, to Niagara Falls, N.Y. September 17, 1952. 1,958.796 km. (1,217.1 miles).

Altitude (France).
Jean Boulet in a Sud-Est S.E.3130 Alouette, at Buc, near Paris, June 6, 1955. 8,209 m. (26,932 ft.).

Speed (U.S.A.).
W./O. B. I. Wester in a Sikorsky XH-39. Windsor Locks, Connecticut. August 26, 1954. 251,067 km.h. (156.006 m.p.h.).

Point-to-Point Speed Records

The following are the principal Point-to-Point Speed Records which have been homologated by the F.A.I. since 1952.

Cape Town-London (Great Britain).
Wing Cdr. A. H. Humphrey and Sq. Ldrs. D. Bower and R. F. B. Powell, R.A.F., in an English Electric Canberra B. Mk. 2. December 19, 1953. Time : 13 hr. 16 min. 25 sec. Speed : 728.648 km.h. (452.76 m.p.h.).

Los Angeles-Paris (France).
Capt. Ch. Billet, P. Wertheimer, R. Girard and P. Lemaître in a T.A.I. Douglas DC-6. May 28-29, 1953. Time : 20 hr. 26 min. Speed : 444.681 km.h. (276.31 m.p.h.).

Los Angeles-New York (U.S.A.).
Colonel W. W. Millikan, U.S.A.F., in a North American F-86F. January 2, 1954. Time : 4 hr. 6 min. 16 sec. Speed : 959.027 km.h. (595.91 m.p.h.).

Paris-London (Great Britain).
M. J. Lithgow in a Supermarine Swift Mk. 4. July 5, 1953. Time : 19 min. 14.2 sec. Speed : 1,069.291 km.h. (664.43 m.p.h.).

London-Amsterdam (Great Britain).
Lieut. J. P. S. Overbury, R.N., in a Hawker Sea Hawk. July 29, 1954. Time : 23 min. 30.9 sec. Speed : 919.760 km.h. (571.511 m.p.h.).

London-Basra (Great Britain).
Flt. Lieuts. R. L. E. Burton and D. H. Gannon, R.A.F., in an English Electric Canberra P.R. Mk. 3. October 8, 1953. Time : 5 hr. 11 min. 5.6 sec. Speed : 876.011 km.h. (544.35 m.p.h.).

London-Cape Town (Great Britain).
Wing Cdr. G. G. Petty, Sq. Ldrs. T. P. MacGarry and J. McDonald Craig, in English Electric Canberra B. Mk. 2. December 17, 1953. Time : 12 hr. 21 min. 3.8 sec. Speed : 783.078 km.h. (486.581 m.p.h.).

London-Christchurch (Great Britain).
Flts. Lieuts. R. L. E. Burton and D. H. Gannon, R.A.F., in an English Electric Canberra P.R. Mk. 3. October 8-9, 1953. Time : 23 hr. 50 min. 42 sec. Speed : 795.887 km.h. (494.54 m.p.h.).

London-Colombo (Great Britain),
Wing Cdr. L. M. Hodges and Sq. Ldr. R. Currie, R.A.F., in an English Electric Canberra P.R. Mk. 7. October 8-9, 1953. Time : 10 hr. 25 min. 42 sec. Speed : 836.004 km.h. (519.47 m.p.h.).

London-Darwin (Great Britain).
Flt. Lieuts. L. M. Whittington and J. A. Brown, R.A.F., in an English Electric Canberra B. Mk. 2. January 27-28, 1953. Time : 22 hr. 0 min. 21.8 sec. Speed : 629.553 km.h. (391.19 m.p.h.).

London-Khartoum (Great Britain).
G./C. J. Cunningham in de Havilland Comet 2. January 22, 1954. Time : 6 hr. 22 min. 7.2 sec. Speed : 774.299 km.h. (481.126 m.p.h.).

London-Melbourne (Great Britain).
Captain W. Baillie in a B.E.A. Vickers Viscount 701. October 8-10, 1953. Time : 35 hr. 46 min. 47.6 sec. Speed : 472.517 km.h. (293.61 m.p.h.).

London-Paris (Great Britain).
M. J. Lithgow in a Supermarine Swift Mk. 4. July 5, 1953. Time : 19 min. 14 sec. Speed : 1,077.417 km.h. (669.47 m.p.h.).

London-Karachi (Great Britain).
Flt. Lieuts. L. M. Whittington and J. A. Brown, R.A.F., in an English Electric Canberra B. Mk. 2. January 27, 1953. Time : 8 hr. 52 min. 28.2 sec. Speed : 711.085 km.h. (441.85 m.p.h.).

THE AIRLINES OF THE WORLD

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
ADEN								
Aden Airways Ltd.	Khormaksar, Aden Gen. Manager : Stephen Broad, M.B.E.	6 Douglas DC-3 *On order :* 2 Douglas DC-3 1 D.H. Rapide	6,000	969,479 *250,102*	21,000 *5,507*	171,600	2,544,520 *601,057*	A wholly-owned subsidiary of B.O.A.C.
ALASKA								
Alaska Airlines, Inc.	2320, Sixth Avenue, Seattle 1, Washington President : N. David	2 Douglas DC-4 3 Douglas DC-3 1 Curtiss Commando 13 smaller aircraft	5,587	2,403,312 *101,805*	26,633 *2,655*	1,259,141	3,866,000 *5,864,000*	—
Alaska Coastal Airlines	2, Marine Way, Juneau, Alaska Joint Managers : S. B. Simmons D. F. Benecke	1 Consolidated 28-5ACF 7 Grumman Goose 1 Grumman Widgeon 1 Lockheed Vega 1 Bellanca Pacemaker 1 Republic Seabee 2 Piper Pacer *On order :* 2 Grumman Goose 1 Piper Pacer	3,200	805,141 *64,715*	40,577 *1,956*	1,062,141	1,118,257 *109,230*	A partnership of Alaska Air Transport, Inc. and Marine Airways Corpn.
Bristol Bay Airlines	Dillingham, Alaska Owner and Operator: Robert D. Fenno	2 Stinson Station Wagon 2 Bellanca Skyrocket 2 Cessna T-50.	—	—	—	—	—	Operates eight scheduled services in Bristol Bay area.
Byers Airways, Inc.	Box 1410, Fairbanks, Alaska President : R. D. Byers	1 Stinson Reliant 1 Cessna 170 3 Cessna 180 1 Cessna 140 1 Aeronca Sedan	1,207	113,607 *25,416*	1,227 *282*	*220,158*	176,940 *37,192*	—
Christensen Air Service	Anchorage, Alaska Owner and Operator: Hakon Christensen	1 Waco Aristocrat 1 Grumman Widgeon	—	—	—	—	—	Operates a scheduled service between Anchorage and Seward.
Cordova Airlines, Inc.	Anchorage, Alaska President and Manager : M. K. Smith	2 Douglas DC-3 2 Cessna 180 2 Cessna 170 1 Piper Super Cub 1 Grumman Widgeon *On order :* 1 Cessna 170	1,353	311,047 *263,532*	10,518 *3,398*	26,783	82,116 *116,166*	—
Ellis Air Lines	Ketchikan, Alaska President : R. E. Ellis	7 Grumman Goose 2 Aeronca Sedan 1 Cessna 180	542	553,963 *147,685*	46,331 *6,134*	478,590	1,099,680 *17,709*	—
Munz Airways	P.O. Box 639, Nome, Alaska Owner and Operator : William S. Munz	3 Stinson 3 Howard	—	—	—	—	—	—
Northern Consolidated Airlines, Inc.	Pouch No. 1, International Airport, Anchorage President : R. I. Petersen	3 Douglas DC-3 2 Noorduyn Norseman 12 Cessna T-50 2 Stinson 1 Convair Catalina	3,446	1,017,999 *124,117*	9,683 *1,768*	1,260,000	2,682,000 *650,000*	—
Pacific Northern Airlines, Inc.	1626, Exchange Building, Seattle 4, Washington President : A. ~~G. Woodley~~ Vice-President (Ops.) : J. A. Cunningham	5 Douglas DC-4 4 Douglas DC-3 *On lease :* 3 Lockheed Constellation 649	4,489	3,386,798 *50,656*	75,950 *2,102*	2,610,595	7,496,000 *32,000*	—
Reeve Aleutian Airways, Inc.	Box 559, Anchorage, Alaska President : R. C. Reeve	3 Douglas DC-3 2 Sikorsky S-43 1 Grumman Goose 1 Boeing 80-A 2 Fairchild 71	2,912	316,934 *172,350*	2,968 *496*	130,161 ton-miles	50,036 ton-miles *187,401 ton-miles*	—
Wein Alaska Airlines, Inc.	Fairbanks, Alaska President : S. Wien	3 Curtiss Commando 3 Douglas DC-3 22 Single-engined aircraft	4,150	1,070,176 *387,461*	11,499 *1,790*	231,611	265,687 *647,936*	—
ALGERIA								
Compagnie Générale de Transport Aérien (C.G.T.A. Air) Algérie	46, Boulevard Saint-Saëns, Algiers President : J. Richard-Deshais	4 Douglas DC-4 2 Douglas DC-3 *On order :* 2 Douglas DC-6B	—	109,171	105,925	—	3,843,871	—
ARGENTINA								
Aerolineas Argentinas (E.N.T.)	Paseo Colón 185, Buenos Aires Gen. Manager : C. A. Aluarez Ops. Manager : A. F. Bazzani	6 Douglas DC-6 5 Douglas DC-4 18 Douglas DC-3 4 Convair 240 6 Short Sandringham	35,639	9,352,628 *164,462*	291,988 *2,032*	1,125,063 *1,653*	3,381,709 *115,873*	A branch of "Empresa National de Transportes" which manages all State-owned Transport.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
ARGENTINA—*cont.*								
Lineas Aereas del Estado (L.A.D.E.)	Corrientes 480, Buenos Aires Director : Brigadier A. E. B. Jidela Gen. Manager : M. S. Claria	Douglas DC-4 Douglas DC-3 Vickers Viking	1,883	—	—	—	—	Operated by the Argentine Air Force.
AUSTRALIA								
Airlines (W.A.) Ltd.	55, St. George's Terrace, Perth, W.A. Chairman : E. S. Saw Man. Director : J. W. Cameron	4 D.H. Dove	6,007	—	—	—	—	—
Ansett Airways Pty., Ltd.	Commonwealth Aerodrome, Essendon, Melbourne, Victoria Man. Director : R. M. Ansett Gen. Manager : R. D. Collins	6 Douglas DC-3 2 Short Sandringham 2 Convair 340	4,838	3,477,034	165,545	32,010	12,917,902	Absorbed Ansett Flying Boat Services, July 1, 1954.
Ansett Flying-Boat Services Pty., Ltd.	—	—	—	—	—	—	—	Absorbed by Ansett Airways July 1, 1954.
Australian National Airways Pty., Ltd. (A.N.A.)	Corner Latrobe and William Sts., Melbourne, Victoria Man. Director : Capt. I. N. Holyman Gen. Manager : F. Kay Ops. Manager : G. H. Archibald	2 Douglas DC-6 2 Douglas DC-6B 8 Douglas DC-4 16 Douglas DC-3 4 Douglas DC-3 (Freight) 3 Bristol Freighter	12,651	14,361,428 *517,426*	638,191 *21,620*	2,016,836 *9,866*	81,691,967 *2,353,202*	Has operational control of Townsville and Country Airways, holds controlling interest in Guinea Airways Ltd., and is shareholder in Air Ceylon and Air Beef.
Butler Air Transport Ltd.	Kingsford-Smith Airport, Mascot, N.S.W. Man. Director : C. A. Butler Gen. Manager : T. Williams Ops. Manager : T. R. Young	6 Douglas DC-3 2 D.H. Heron *On order :* 2 Vickers Viscount	8,389	2,687,700	156,643	8,582,0009	81,230,000	Queensland Airlines Pty., Ltd. is a subsidiary.
Conellan Airways Ltd.	Townsite Aerodrome, Alice Springs N.T. Gov. Director : E. J. Connellan	2 D.H. Rapide 1 D.H. Dragonfly 2 D.H. Tiger Moth 1 Auster Aiglet 1 Beechcraft D17S	10,338	269,500	1,258	72,710	107,145	—
East-West Airlines, Ltd.	P.O. Box 249, Tamworth, N.S.W. Chairman : D. M. Shand Gen. Manager : A. J. Smith	Douglas DC-3 2 Lockheed Hudson	1,496	—	—	—	—	—
Guinea Airways, Ltd.	Airways House, 132, North Terrace, Adelaide, S.A. Chairman : S. Powell	4 Douglas DC-3 1 Fairchild Argus *On order :* 1 Auster Super Autocar	1,642	838,568 *16,575*	86,164 *1,080*	172,514	2,688,619	—
MacRobertson-Miller Aviation Co. Pty., Ltd.	194, St. George's Terrace, Perth, W.A. Man. Director : H. C. Miller	4 Douglas DC-3 5 Avro Anson	12,681	1,644,379 *190,166*	27,233 *910*	116,316 *538*	2,690,928 *3,187,621*	Air Beef Pty., Ltd. is an affiliate.
Qantas Empire Airways, Ltd. (Q.E.A.)	Shell House, 2, Carrington St., Sydney, N.S.W. Man. Director : Sir Hudson Fysh, K.B.E., D.F.C. Gen. Manager : C. O. Turner	4 Lockheed Super Constellation 4 Lockheed Constellation 749A 5 Douglas DC-4 8 Douglas DC-3 3 Short Sandringham 1 D.H. Drover 2 Convair Catalina 3 D.H. Beaver *On order :* 8 Lockheed Super Constellation 1 D.H. Beaver	58,904	10,420,731	113,871	2,686,200	12,981,474	A public company in which Australian Government holds shares. Took over Trans-Pacific routes of B.C.P.A. on April 1, 1954.
Queensland Airlines Pty., Ltd.	Brisbane Airport, Queensland Chairman : D. S. Aarons Man. Director : R. S. Adair, O.B.E. Ops. Manager : Capt. M. B. Mitchell	3 Douglas DC-3 *On order :* 6 Handley Page Herald	4,381	920,920 *30,000*	54,544 *1,240*	25,500	2,125,251 *1,200*	An Associate of Butler Air Transport Ltd.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
AUSTRALIA—*cont.*								
Trans-Australia Airlines (T.A.A.)	339, Swanston Street, Melbourne, Victoria Chairman: G. P. N. Watt, C.B.E. Gen. Manager: J. P. Ryland Ops. Director: J. Chapman	3 Vickers Viscount 5 Convair 240 4 Douglas DC-4 24 Douglas DC-3 4 D.H. Drover 4 D.H. Dragon *On order:* 6 Vickers Viscount	27,416	15,870,870	669,554	2,312,271	38,026,260	State-owned.
Woods Airways Pty., Ltd.	National House, 49, William Street, Perth, W.A. Australia Man. Director: James Woods	2 Avro Anson	25	25,300	4,295	1,500	—	Operates the shortest scheduled airline route in the World, between Perth and Rottnest Island.
BAHREIN								
Gulf Aviation Co., Ltd.	The Aerodrome, Moharaq, Bahrein Chairman: G. Beeby-Thompson Exec. Director: G. F. W. Parker	4 D.H. Dove	713	409,685	35,393	79,188	164,277	A partially-owned subsidiary of B.O.A.C.
BELGIUM								
Société Anonyme Belge d'Exploitation de la Navigation Aérienne (SABENA)	Air Terminus, Brussels President: Gilbert Périer Man. Director: Gaston Claeys Gen. Manager: Willem Deswarte	7 Douglas DC-6B 2 Douglas DC-6A 5 Douglas DC-6 7 Douglas DC-4 19 Douglas DC-3 9 Douglas C-47 4 Convair 240 4 Sikorsky S-55 *On order:* 1 Douglas DC-6B 2 Sikorsky S-55	—	15,590,675 *1,864,014*	365,211 *26,545*	5,137,463 *439,644*	27,978,234 *7,498,649*	State and private interests. Each have 50% interest.
Société Belge de Transports par Air S.A. (SOBELAIR)	137, Rue Royale, Brussels G. Claeys A. Philippe P. Bertin J. Carlier	1 Douglas DC-4 3 Douglas DC-3	—	— *759,778*	— *3,155*	—	— *69,838*	Private company operating between Belgium and The Belgium Congo.
BOLIVIA								
Lloyd Aéreo Boliviano S.A. (L.A.B.)	Casilla 132, Cochabamba President: J. V. Altamirano Gen. Manager: Cmdte. W. Lehm	8 Douglas DC-3 3 Douglas C-47 4 Boeing B-17 *On order:* 2 Douglas DC-4	7,116	3,012,372	144,005	43,162	55,224,207	—
BRAZIL								
Companhia Itaú de Transportes Aéreos	Rua Asdqubal do Nascimento 436, São Paulo President: Dr. J. D. Oliva Gen. Manager: Mario Rappa	6 Curtiss Commando	18,369	107,997	—	—	7,936,721	Operates freight services only.
Consorcio Loide Aéreo Nacional S.A. (LOIDE)	Avenida Treze de Maio, 13-27° Andar, Rio de Janeiro President: Gen. J. M. Lima Gen. Manager: Col. M. G. Jacques	12 Curtiss Commando *On order:* 3 Vickers Viscount	—	—	—	—	—	A consortium of Loide Aéreo Nacional S.A., Linhas Aéreas Paulistas and Transportes Aéreos Bandeirantes Ltda.
Consorcio Nacional de Transportes Aéreos (Nacional)	Edificio Carnasciali, 514-200-8°, Avenida Beiro Mar, Rio de Janeiro	Douglas DC-3 Curtiss Commando	—	—	—	—	—	A consortium of Central Aérea Ltda., Organisação Mineira de Transportes Aéreos, Transportes Aéreos Nacional Ltda. and Vição Aérea Brasil S.A.
Empresa de Transportes Aéreos Catarinense S.A. (T.A.C.)	Felipe Schmidt 14, Florianopolis, Santa Catarina President: Dr. J. D. F. Lima	Douglas DC-3	—	—	—	-	—	Operates with assistance from Cruzeiro do Sul.
Empresa de Transportes Aéreos Norte do Brasil Ltda. (Aéronorte)	Avenida Pedro II, 258-D, Sao Luiz, Maranhão President: A. M. de Barros	4 Douglas DC-3 1 Lockheed Electra 5 Norecrin	—	—	—	—	—	A wholly-owned subsidiary of Aérovias, operating an extensive feeder network.
Empresa de Transportes Aérovias Brasil S.A. (Aérovias).	Rua Conselheiro Crispiniano 379, 2° Andar São Paulo, S.P. President: A. Junqueira Filho	—	—	—	—	—	—	See Real S.A. Transportes Aéreos.
Navegacão Aérea Brasileira S.A. (N.A.B.)	Santos Dumont Airport Rio de Janerio	4 Douglas DC-3 1 Beechcraft 1 Lockheed Electra	—	—	—	—	—	—

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
BRAZIL—*cont.*								
Panair do Brasil S.A. (P.A.B.)	Santos Dumont Airport Rio de Janeiro President : P. Sampaid Gen. Manager : C. C. Araujo	11 Lockheed Constellation 14 Douglas DC-3 5 Convair PBY-5A *On order :* 4 D.H. Comet	48,543	12,322,476	359,306	965,977	10,488,882	An affiliate of Pan American World Airways.
S.A. Emprêsa de Uiação Aérea Rio Grandense (UARIG)	P.O. Box 243, Av. Borges de Medeiros 410, 16° Andar Pôrto Alegre President : R. M. Berta Ops. Manager : G. G. Herzfeldt	23 Douglas DC-3 13 Curtiss Commando *On order :* 3 Lockheed Super Constellation 2 Convair 340 3 Curtiss Commando	13,505	—	—	—	—	—
Real S.A. Transportes Aéreos (REAL)	Rua Conselheiro Crispiniano 379, 2° Andar São Paulo, S.P. President : Linneu Gomes	3 Douglas DC-4 6 Convair 340 53 Douglas DC-3 *On order :* 3 Douglas DC-6B	—	13,770,905	1,072,504	382,061	15,080,873	Fleet and traffic figures are for Real and Aérovias combined. Real holds 87% of Aérovias shares but companies operate under own names.
S.A. Viação Aérea Gaúzha (SAVAG)	Edificio Camara do Comércio, Rio Grande do Sul President : E. C. Becker Manager : Tulio Fruet	6 Douglas DC-3	393	281,521 *2,002*	23,588 *286*	26,246	1,277,309	Administrative and technical assistance is given by Cruzeiro do Sul.
Serviços Aéreos Cruzeiro do Sul Ltda. (Cruzeiro)	Avenida Rio Branco 128, Caixa Postal 190, Rio de Janeiro President : J. B. R. Dantas Ops. Director : O. Mueller	4 Convair 340 34 Douglas DC-3 6 Beechcraft AT-11	23,902	10,552,456 *624,428*	391,469 *10,311*	332,468 *4,844*	15,710,712 *359,609*	—
Transportes Aéreos Salvador Ltda. (TAS)	Av. Joana Angelica -8, Salvador, Bahia Gen. Manager : C. P. Horta	2 D.H. Heron 4 Beechcraft Bonanza *On order :* 1 D.H. Heron	—	—	—	—	—	State-subsidised domestic airline.
Viação Aérea São Paulo S.A. (VASP)	Rua Líbero Baderó 89, São Paulo President : Prof. L. Gualberto	16 Douglas C-47 5 Saab Scandia 90-A-2 1 Beechcraft C-45 *On order :* 4 Saab Scandia	6,592	3,745,400	252,263	—	—	State of São Paulo holds 51% interest.
BRITISH CENTRAL AFRICA								
Central African Airways Corporation	Salisbury Airport, P.O. Box 1979, Salisbury, S. Rhodesia Gen. Manager : P. J. B. Wimbush Ops. Manager : R. A. Bourlay	10 Vickers Viking 6 Douglas DC-3 6 D.H. Beaver *On order :* 5 Vickers Viscount	14,322	4,653,062 *386,560*	131,431 *2,869*	926,080 *55*	2,219,770 *146,920*	Owned by the Federation of Rhodesia and Nyasaland.
BRITISH EAST AFRICA								
Caspar Air Charters and Agencies Ltd.	24/25 Mutual Building, Hardinge Street, Nairobi Man. Director : E. B. Fielden	4 D.H. Rapide 1 Avro Anson 1 Miles Messenger 1 Piper Pacer 2 Leopard Moth	665	—	—	—	—	Operates scheduled service round Lake Victoria in association with East African Airways.
East African Airways Corporation	Sadler House, Sadler Street, Nairobi, Kenya Colony Gen. Manager : Capt. M. Sorsbie, O.B.E.	10 Douglas DC-3 2 D.H. Rapide	20,824	2,213,654 *282,618*	93,227	631,693	4,670,132	—
BRITISH GUIANA								
British Guiana Airways, Ltd.	32, Main Street, Georgetown Man. Director : Col. A. J. Williams, O.B.E.	3 Douglas C-47A 2 Grumman Goose G-21A	2,100	—	—	6,808	7,251,906	—
BRITISH WEST AFRICA								
West African Airways Corporation	Airways House, Lagos Airport, Ikeja, Nigeria Gen. Manager : Col. M. C. P Mostert, O.B.E.	5 Bristol 170 8 D.H. Dove *On order :* 5 D.H. Heron 2	9,411	1,530,615 *272,461*	68,415	212,540 ton-miles	459,771 ton-miles	Owned jointly by Governments of Nigeria (68%), Gold Coast (29½%) Sierra Leone (2%) and Gambia (½%).

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
BRITISH WEST INDIES								
Bahamas Airways, Ltd.	Oakes Field, Nassau, Bahamas President : Sir Miles Thomas Exec. Director : B. G. W. Wiggett Comm. Manager : H. W. Woodman	4 Grumman Goose *On order :* 2 D.H. Heron	2,434	350,743 *142,627*	16,938 *3,065*	—	77,742	A subsidiary of B.O.A.C.
British West Indian Airways, Ltd. (B.W.I.A.)	Airways House, Chacon Street, Port-of-Spain, Trinidad President : Sir Miles Thomas, D.F.C. Gen. Manager : J. H. Rahr.	5 Vickers Viking 3 Douglas DC-3 *On order :* 4 Vickers Viscount	6,475	1,321,845 *532,272*	61,982 *4,619*	173,574 *1,134*	366, 932 *5,279*	A wholly-owned subsidiary of B.O.A.C.
BULGARIA								
Bulgarski Vzduszni Linii (TABSO)	12, Place Narodno, Sabranie, Sofia	IL-12 LI-2	—	—	—	—	—	—
BURMA								
Union of Burma Airways (U.B.A.	104, Strand Road, Rangoon Gen. Manager : U. Taw	3 D.H. Dove 9 Douglas C-47 3 Miles Marathon 1 Auster 1 Consul	4,308	—	—	—	—	Controlled by a Government Board.
CANADA								
Boreal Airways, Ltd.	31, St. James Street West, Montreal, P.Q. President and Gen. Manager : P. E. Lariviere	1 Lockheed 10A 4 Noorduyn Norseman 3 Fairchild F-11 Husky 3 D.H. Beaver 1 Cessna 180 1 Stinson Reliant	—	375,837	8,186	—	2,637,750	Operates a regular service between Bagotville, Roberval, St. Felicien and Chibougamau.
Canadian Pacific Air Lines, Ltd. (C.P.A.L.)	International Airport, Vancouver, A.M.F., B.C. President : G. W. G. McConachie Ops. Manager : R. B. Phillips	4 Douglas DC-6B 1 Douglas DC-4 5 Convair 240 15 Douglas DC-3 6 Curtiss C-46F 2 Canso PBY-5A 1 Avro Anson 2 Noorduyn Norseman	36,021	7,563,922 *1,767,961*	233,376 *13,589*	2,955,707 *27,624*	6,959,023 *90,239*	Wholly-owned subsidiary of the Canadian Pacific Railway Company.
Central Northern Airways, Ltd.	Hangar No. 5, Winnipeg Airport, Manitoba President : G. H. Sellers Gen. Manager M. E. Ashton	1 Bellanca Airbus 10 Noorduyn Norseman 2 Lockheed Hudson 2 Canso PBY5A 1 Republic Seabee 6 Avro Anson 2 Stinson 1 D.H. Beaver 2 Waco 2 Curtiss Wright Commando	4,200	78,716 *871,938*	12,267	470,786	4,966,414	Aircraft Services (Western) Ltd. is a wholly-owned subsidiary.
Leavens Bros. Air Services, Ltd.	3220, Dufferin St., Toronto, Ontario President and Gen. Manager : C. R. Leavens	3 Cessna T-50	50	26,440 *20,948*	1,348 *945*	73,965	11,701 *56,020*	—
Maritime Central Airways, Ltd.	Charlottetown, P.E.I. President : J. K. Curran Gen. Manager : C. F. Burke Ops. Manager : H. S. Jones	9 Douglas DC-3 4 Curtiss Commando 2 Avro York 3 Canso PBY-5A 1 Bristol Freighter 3 Lockheed Electra 2 Avro Anson 1 D.H. Beaver	1,217	3,000,000	65,000	800,000	9,484,160	—
Mont Laurier Aviation Co., Ltd.	Montreal, P.Q. Gen. Manager : J. P. Sesir	1 Canso Amphibian 1 Douglas DC-3	—	— *142,554*	— *1,200*	— *6,779*	— *577,023*	—
Quebecair, Inc.	Rimouski, P.Q. President : R. Crevier Ops. Manager : P. Lapointe	1 Douglas DC-4 4 Douglas DC-3 1 Beech D-18S 3 D.H. Beaver *On order :* 1 Douglas DC-4 2 PBY Canso Amphibian	1,069	574,232	105,635	845,688	3,575,564	—
Queen Charlotte Airlines, Ltd.	Vancouver, A.M.F., B.C. Man. Director : A. J. Spilsbury Ops. Manager : E. W. Bendall	2 Canso Amphibian 2 Douglas DC-3 5 Noorduyn Norseman 2 Cessna 180 *On order :* 3 D.H. Beaver 2 Cessna 180	4,972	286,402 *645,700*	39,031 *17,596*	113,961 *52,156*	233,552 *173,901*	—

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Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
CANADA—*cont.*								
Saskatchewan Government Airways	Box 850, Prince Albert, Saskatchewan Gen. Manager: Ian MacLeod Ops. Manager: F. R. Bau Dais	1 Douglas DC-3 5 Noorduyn Norseman 4 D.H. Beaver 3 Cessna 180 1 Cessna 170 4 Cessna 140 1 Stinson 1 Avro Anson	—	895,610	11,401	54,445	2,841,196	—
Trans-Canada Airlines (T.C.A.)	International Aviation Building, Montreal, P.Q. President: G. R. McGregor Vice-President (Ops.): W. F. English	22 Canadair DC-4M2 North Star 1 Lockheed Super Constellation 27 Douglas DC-3 3 Bristol Freighter *On order:* 25 Vickers Viscount 2 Lockheed Super Constellation	24,000	32,237,405	1,438,349	16,065,756	21,465,791	An autonomous Government-owned Corporation.
CEYLON								
Air Ceylon, Ltd.	P.O. Box 692, 3, Lotus Road, Colombo Gen. Manager: J. L. M. Fernando Manager: Kenneth De Croos	2 Douglas DC-3	1,115	—	—	—	—	—
CHILE								
Linea Aérea Nacional de Chile (L.A.N.)	Los Cerrillos, Santiago President: A. Fernández Ops. Manager: J. Amunátegui	4 Martin 202 15 Douglas DC-3 9 D.H. Dove 2 Lockheed Electra 1 Beechcraft Bonanza *On order:* 3 Douglas DC-6B 3 Douglas DC-3	8,962	4,319,772	182,735	3,784,363	215,633	State-owned.
CHINA (Communist)								
Sino-Soviet Aviation Corporation (Hamiata)	Urumchi, Sinkiang	LI-2	—	—	—	—	—	Jointly owned by China and U.S.S.R.
Skoga	Peking	—	—	—	—	—	—	Operates between Peking and Moscow in association with Aeroflot.
CHINA (Nationalist)								
Civil Air Transport (C.A.T.)	46, Chung Shan Road North, Taipei, Taiwan Chairman: General C. L. Chennault President: A. T. Cox	2 Douglas DC-4 6 Douglas DC-3 23 Curtiss Commando 2 Convair Catalina	5,561	—	—	—	—	—
Foshing Airlines	30, Shinn Yang St., Taipei, Taiwan Chairman: Moon F. Chin Gen. Manager: Ango Tai	3 Convair Catalina 1 Curtiss Commando	770	—	—	—	—	—
COLOMBIA								
Aerovias Nacionales de Colombia, S.A. (Avianca)	Carrera 7A, No. 16-14, Bogotá President: G. A. Obregón	3 Lockheed 1049E 1 Lockheed 749A 13 Douglas DC-4 23 Douglas DC-3 13 Douglas C-47 5 Curtiss C-46 *On order:* 1 Lockheed 1049G	32,243	14,468,317 *88,605*	836,816	6,095,1701	59,311,749	Aerotaxi is a wholly-owned subsidiary.
Lloyd Aereo Colombiano (LAC)	Bogota	—	—	—	—	—	—	Formed 1954.
Sociedad Aérea del Tolima S.A. (SAETA)	Calle 19, No. 6-39—6-14, Bogota Gen. Manager: Jaime Reyes-Patria Ops. Manager: Raul Garavito D.	5 Douglas DC-3	85	—	—	—	—	Avianca holds 30% interest.
Sociedad Aeronautica Medellin S.A. (S.A.M.)	Calle 51, No. 53-34, Apartado Aereo No. 1085, Medellin Gen. Manager: Pedro A. Mena V.	6 Curtiss Commando 6 Douglas DC-3 1 Douglas B-18	10,178	2,335,911	—	4,770,061	60,590,356	Operates scheduled freight services. To start Domestic passenger service June, 1955.
Uraba, Medellin and Central Airways, Inc. (UMCA)	320, Caraboba, Medellin President: E. Balluder	2 Convair 240	328	—	—	—	—	Pan-American World Airways has a substantial interest.

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Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
COSTA RICA								
Lineas Aéreas Costarricenses, S.A. (LACSA)	San José, Costa Rica, P.O. Box 1531, Avenida 1A No. 39E Gen. Manager : R. E. Smith Ops. Manager : Jorge París	4 Curtiss Commando 3 Douglas DC-3 *On order :* 2 Convair 340	3,851	1,291,481 *425,331*	102,374 *7,251*	—	13,114,224 *4,310,930*	An affiliate of Pan American World Airways (36% interest). State has 20% interest and private citizens 44%.
CUBA								
Aerovias "Q" S.A.	Cienfugos 72, Havana Gen. Manager : M. Quevedo, Jr. Ops. Manager : J. E. Alvarez del Regato	6 Douglas DC-3 2 Budd Conestoga	1,587	—	—	—	—	—
Compañia Cubana de Aviación S.A. (Cubana)	Calle 23, No. 105, Vedado, Havana President : Sergio I. Clark Gen. Manager : Eusebio D. Figuerova	1 Douglas DC-4 6 Douglas DC-3 3 Lockheed Constellation 1 Cessna *On order :* 3 Lockheed Super Constellation	9,453	—	—	—	—	—
Cuba Aeropostal S.A. (C.A.S.A.)	Apartado Postal 302, Havana President : G. E. Alfonso	4 Curtiss Commando	480	440,676	—	17,733	15,575,015	—
Expreso Aereo Inter-Americano S.A. (Expreso)	Prado 50, Havana Gen. Manager : Jose A. Galdo Ops. Manager : Capt. R. Trusillo	3 Curtiss Commando	325	—	—	—	—	Official airmail carrier.
CYPRUS								
Cyprus Airways, Ltd.	18, Homer Avenue, Nicosia Gen. Manager : J. A. Jick	6 Douglas DC-3	6,285	1,186,294 *126,965*	35,647	284,396	800,278	Jointly owned by B.E.A. (23%), B.O.A.C. (23%), Cyprus Government (32%) and Cypriot citizens (22%).
CZECHOSLOVAKIA								
Ceskoslovenské Aerolinie, N.P. (C.S.A.)	Nam Republiky Palace, Kotua, Prague 1	IL-12 Douglas DC-3	—	—	—	—	—	—
DENMARK								
Det Danske Luftfartselskab A/S. (D.D.L.)	Dagmarhus, Copenhagen V. Chairman : Per Kampmann President : K. Lybye	—	—	—	—	—	—	A non-operating holding company in the S.A.S. consortium. See under "Scandinavia."
DOMINICAN REPUBLIC								
Compania Dominicana de Aviacon C. por A.	General Andrews Airport, Ciudad Trujillo President : C. A. McLaughlin Vice-President : G. M. Burrie	4 Curtiss Commando 2 Douglas DC-3 1 D.H. Beaver	1,409	755,151	31,068	4,678	8,456,465	Pan American World Airways has a 40% interest.
ECUADOR								
Aerovias Ecuatorianas C.A.	661, Calle Garcia Moreno, P.O. Box 2226, Quito President : Luis Arias Gen. Manager : L. Rivas B.	2 Boeing Stratoliner 3 Douglas DC-3 1 Douglas C-47 3 Ryan Navion 5 Avro Anson	3,533	—	—	—	—	—
EGYPT								
Misrair S.A.E.	Almaza Airport, Heliopolis Gen. Manager : Mohamed Fayek El Serafi	3 Languedoc 161 7 Vickers Viking 1 Beechcraft D18S *On Order :* 3 Vickers Viscount	8,636	1,871,340 *118,740*	63,069	103,866	3,762,518	—
EL SALVADOR								
Taca International Airlines S.A.	San Salvador President : R. H. Kriete	5 Douglas DC-4 21 Douglas DC-3	3,219	—	—	—	—	A subsidiary of the TACA Corporation, Alabama, U.S.A.
ETHIOPIA								
Ethiopian Air Lines, Inc.	Addis Ababa President : H. E. Lt. Araya Abebe Gen. Manager : W. G. Golien	2 Convair 240 8 Douglas DC-3	6,217	—	—	—	—	—
FIJI ISLANDS								
Fiji Airways	P.O. Box 112, Princes Road, Suva Man. Director : Harold Gatty	3 D.H. Rapide *On order :* 2 D.H. Drover	1,488	—	—	—	—	Traffic figures not issued.

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Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
FINLAND								
Aero Osakeyhtio (Finnair)	Mannerheimintie 9B, Helsinki Man. Director : Lt. Gen. Leonard Grandell	3 Convair 340 9 Douglas DC-3	3,777	3,075,744 *62,794*	221,447 *3,107*	489,973 *74,454*	1,287,934 *313*	State owns 73% interest.
Veljekset Karhumäki O/Y (Karhumäki Airways)	Helsinki, 3, Lönnrotinkatu President : N. Karhumäki Man. Director : U. Karhumäki	3 Douglas DC-3 1 Lockheed Lodestar	601	207 088 *87,419*	17,452 *2,213*	4,001	15,543	—
FRANCE								
Compagnie de Transportes Aériens Intercontinentaux (T.A.I.)	23, Rue de la Paix, Paris, 2° President : P. Bernard Dir. General : Général G. Fayet	3 Douglas DC-6B 3 Douglas DC-4 *On order :* 2 Douglas DC-6B	20,370	4,958,666	43,728	442,761	3,612,427	—
Compagnie Nationale Air France (Air France)	2, Rue Marbeuf, Paris 8° President : Max Hymans Director General : Louis Lesieux	8 Lockheed Super Constellation 20 Lockheed Constellation 12 Vickers Viscount 18 Douglas DC-4 36 Douglas DC-3 10 Caudron Goëland 5 Morane 8 Breguet Deux-Ponts *On order :* 1 Breguet Deux-Ponts 10 Lockheed Super Constellation 1049G 12 Lockheed Super Constellation 1649	141,428	38,590,501 *2,216,992*	1,481,281 *45,486*	24,436,914	91,877,736	—
Société Aigle Azur	Avenue des Champs Elysées 70, Paris 8E President : Sylvain Floirat		—	—	—	—	—	Since May 1, 1955, Compagnie Maritime des Chargeurs Réunis has a 60% interest.
Société Auxilaire de Gérance et de Transports Aériens (SAGETA)	23, Rue de l'Amiral D'Estaing, Paris 16° Manager : Général Fayet Director : C. Gonin	7 S.E. 2010 Armagnac	—	1,279,715	15,087	205,431	340,799	—
Société des Lignes Intérieures Air Inter	96, Boulevard Haussman, Paris President : Edouard Catalogue		—		—	—	—	Formed 1954.
Union Aéro-maritime de Transport (U.A.T.)	19, Boulevard Malesherbes, Paris 8E Gen. Manager : L. Vidal	4 Douglas DC-6 1 Douglas DC-4 9 D.H. Heron 3 Nord 2501	—	4,939,441	93,236	—	13,047,416	An Associate of Compagnie Maritime des Chargeurs Réunis.
FRENCH GUIANA								
Société Aérienne des Transport Guyane-Antilles	Cayenne, French Guiana Manager : M. Dumesnil	3 SCAN 30 Amphibian 1 Bell 47D *On order :* 1 D.H. Dragon 1 SCAN Amphibian	57	—	—	—	—	Operates local services with aircraft loaned by French Government.
FRENCH MOROCCO								
Air Atlas/Air Maroc (Compagnie Chérifienne de Transports Aériens) (C.C.T.A.)	65, Avenue de la République, Casablanca Director General : Gustave Chabbert	2 Douglas DC-4 4 S.O. 30P Bretagne 5 Douglas DC-3 *On order* 6 Convair 340	6,600	—				Owned equally by Air France, the Moroccan Government and the Paquet and Fraissinet Shipping Group.
Compagnie Chérifienne du Pont Aérien	1, Rue Magellan, Casablanca	3 Bristol Freighter 2 Douglas DC-3 *On order :* 1 Bristol Freighter	—					Operates car ferry between Arbaoua, Morocco, and Jerez, Spain.
FRENCH TUNISIA								
Société Tunisienne de l'Air (Tunis Air)	1, Rue D'Athenes, Tunis Director General : M. Jung	4 Douglas DC-3 2 SO-161 Languedoc	3,806	—	—			Air France and Tunisian Government each hold 35% of capital.
GERMANY								
Deutsche Lufthansa Aktiengesellschaft (Lufthansa)	Claudiusstrasse 1, Cologne Chairman : Dr. Kurt Weigelt Chief Executive : Hans M. Bongers	4 Lockheed Constellation 4 Convair 340 *On order :* 4 Lockheed Constellation	—					Resumed domestic services, April 1 ; European services May 16; and Trans-Atlantic services June 8, 1955.
GIBRALTAR								
Gibraltar Airways, Ltd.	Cloister Building, Irish Town, Gibraltar Chairman : Sir George Gaggero, O.B.E., J.P.	1 Douglas DC-3	45	—				B.E.A. holds 51% interest ; M. H. Brand & Co. Ltd., Gibraltar Shippers, 49%.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
GREAT BRITAIN								
Air Charter Ltd.	15, Great Cumberland Place, London, W.1 Man. Director : F. A. Laker Ops. Manager : E. N. Jennings	1 Douglas DC-4 3 Bristol 170 Mk. 31 2 Bristol 170 Mk. 32 7 Avro York 3 Avro Tudor	68	2,239,035	22,935	—	52,861,000	Opened a car ferry service between Southend and Calais, September 1, 1954.
Air-Kruise (Kent), Ltd. (Trans-Channel Airways)	Lydd Airport (Ferryfield), Lydd, Kent Man. Director : W/C. H. C. Kennard	2 Douglas DC-3 3 D.H. Rapide *On order :* 2 Douglas DC-3	5,100	200,000 *24,000*	11,000	—	N/A	Operates in association with B.E.A.
Airwork, Ltd.	15, Chesterfield St., London, W.1 Joint Man. Directors : D. N. Wyatt Sir Archibald P. Hope	4 Handley Page Hermes 9 Vickers Viking 1 Douglas DC-3 1 Airspeed Consul 2 D.H. Rapide *On order :* 3 Vickers Viscount 3 Douglas DC-6A	10,397	893,267 *3,876,184*	3,623 *39,869*	2,428	18,511	In addition Airwork operates 5 D.H. Doves and 2 Douglas DC-3's for Sudan Airways, and 8 D.H. Doves and 1 Vickers Viking for the Iraq Petroleum Co.
Aquila Airways, Ltd.	1, Great Cumberland Place, London, W.1 Man. Director : Barry T. Aikman Ops. Manager : R. J. Clark	Short Solent Short Hythe	—	—	—	—	—	Operates flying-boat services from Southampton to Madeira and Capri.
B.K.S. Air Transport, Ltd.	1, Marylebone High Street, London, W.1 Man. Director : C. J. Stevens	2 Vickers Viking 1B 5 Douglas C-47	—	238,537 *667,533*	11,239 *6,457*	—	— *2,802,899*	—
British European Airways Corporation (B.E.A.)	Keyline House, South Ruislip, Middlesex Chairman : Lord Douglas of Kirtleside Chief Executive : Peter G. Masefield Ops. Controller : A. H. Milward	23 Vickers Viscount 701 20 D.H. Airspeed Ambassador 38 Douglas DC-3 Pionair 8 Douglas DC-3 Freighter 8 D.H. Rapide 1 Westland-Sikorsky S.55 2 Bell 47B3 2 Bristol 171-3A *On order :* 3 Vickers Viscount 701 22 Vickers Viscount 802 2 Westland-Sikorsky S-55	21,441	23,064,535 *273,682*	1,829,221	13,876,000	29,116,000	—
British Overseas Airways Corporation (B.O.A.C.)	Airways House, Great West Road, Brentford, Middlesex Chairman : Sir Miles Thomas Ops. Director : Sir Victor H. Tait	22 Canadair Argonaut 16 Lockheed 749 16 Boeing Stratocruiser 5 Avro York (Freight) *On order :* 20 D.H. Comet 4 33 Bristol Britannia 10 Douglas DC-7C 12 Vickers Viscount 700D	81,351	30,376,334 *852,361*	282,633 *3,918*	6,722,000	12,630,000	—
Cambrian Airways, Ltd.	Cardiff Airport, South Wales	3 Douglas DC-3 3 D.H. Dove 2 D.H. Rapide	2,200	1,125,000 *27,000*	27,000 *4,700*	—	—	—
Don Everall (Aviation) Ltd.	Elmdon Airport, Birmingham Chairman : D. Everall Ops. Manager : A. D. Atkinson	3 D.H. Rapide 1 Miles Messenger 1 Auster Autocrat	1,000	55,000 *40,000*	2,100 *550*	—	—	—
Eagle Aviation, Ltd.	29, Clarges Street, London, W.1 Man. Director : H. Bamberg Gen. Manager : Maj. Gen. C. G. B. Greaves C.B., C.B.E. Ops. Manager : J. Suavage	10 Vickers Viking 1B 2 Douglas DC-3 *On order :* 4 Vickers Viking 1B	19,000	134,400 *1,673,600*	1,074 *92,776*	7,134	21,684 *514,700*	—
East Anglian Flying Services Ltd. (Channel Airways)	—	—	—	—	—	—	—	—
Fison-Airwork, Ltd.	Bourne Airfield, Cambridge Chairman : M. D. N. Wyatt, C.B.E.	8 Hiller 360 *On order :* 1 Sikorsky S-55	—	—	—	—	—	Formed 1955 to operate helicoptor services. Airwork Ltd. and Fisons Pest Control Ltd. have equal interests:

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
GREAT BRITAIN—*cont.*								
Hunting-Clan Air Transport, Ltd.	72, Wigmore Street, London, W.1 Man. Director : M. H. Curtis	8 Vickers Viking 4 Douglas DC-3 2 Avro York *On order :* 5 Vickers Viscount	—	3,811,711	85,483	—	—	A subsidiary of Hunting-Clan Air Holdings, Ltd. Operates eleven scheduled routes to points in Europe and to East, West and Central Africa.
Jersey Airlines	4, The Parade, St. Helier, Jersey, C.I. Man. Director : M. C. Thomas Gen. Manager : L. A. Egglesfield	3 D.H. Heron 6 D.H. Rapide *On order :* 2 D.H. Heron	1,971	765,000	60,000	—	135,460	—
Lancashire Aircraft Corporation, Ltd.	—	—	—	—	—	—	—	See "Skyways."
Manx Airlines Ltd.	Ronaldsway Airport, Ballasalla, Isle of Man Man. Director : G. S. Hankinson	2 Douglas DC-3 4 D.H. Rapide	700	156,234 *125,436*	17,116 *4,320*	—	7,951 *51,924*	—
Morton Air Services Ltd.	Croydon Airport, Surrey	—	—	—	—	—	—	—
Olley Air Service Ltd.	Croydon Airport, Surrey	—	—	—	—	—	—	—
Scottish Airlines (Prestwick) Ltd.	Prestwick Airport, Ayrshire Man. Director : D. F. McIntyre Gen. Manager : I. C. Grant	3 Avro York 2 Douglas DC-3 *On order :* 6 Prestwick Twin Pioneer	194	43,262 *1,074,780*	8,692 *7,827*	—	4,500 *16,000*	—
Silver City Airways, Ltd.	1, Great Cumberland Place, London, W.1 Chairman : Eoin C. Mekie Man. Director : Air Commodore G. T. Powell	9 Bristol Super Freighter 6 Bristol Freighter 3 Douglas DC-3 2 D.H. Rapide 1 D.H. Dragonfly 1 Airspeed Consul	1,000	928,067 *511,686*	111,000 *15,000*	— *106,900,000*	— *9,000,000*	A subsidiary of Britavia Ltd. Aquila Airways is an associate. Operates a vehicle ferry (43,000 in 1954) to the Continent.
Skyways Limited and Lancashire Aircraft Corporation Group	7, Berkeley Street, London, W.1 Man. Director : Eric Rylands	6 Handley Page Hermes 23 Avro York 4 Douglas DC-3 3 D.H. Rapide 6 Airspeed Consul 2 Auster 1 Percival Proctor 1 D.H. 86 2 Tiger Moth *On order :* 4 Handley Page Hermes	2,985	1,801,346 *136,284,111*	42,056 *30,048*	—	— *7,800,000*	The Bibby Line has a 49% interest in Skyways from March 1, 1955. Lancashire Aircraft Corporation now operates separately.
Starways, Ltd.	Liverpool Airport, Speke, Liverpool 19	—	—	—	—	—	—	—
Transair, Ltd.	Croydon Airport, Surrey Man. Director : G. H. Freeman Ops. Manager : C. W. H. Bebb	9 Douglas DC-3 *On order :* 2 Vickers Viscount 800	—	2,300,000	—	—	—	—
GREECE								
National Greek Airlines (T.A.E.)	12, Merlin Street, Athens Man. Director : I. G. Reppas	1 Douglas DC-4 15 Douglas DC-3 1 Fairchild	—	—	—	—	—	State-owned.
GUATEMALA								
Empresa Guatemalteca de Aviación (Aviateca)	12, Calle 3-55, Zona 1, Guatemala City President : Col. R. Mendoza	6 Douglas DC-3 1 Douglas DC-4	3,140	777,947	60,664 *2,764*	— *28,882*	543,223 *5,696,444*	State-owned.
HAITI								
Corps d'Aviation de l'Armée d'Haiti	Bowen Field, Port-au-Prince, Haiti Commanding : Lt. Col. G. E. Roy Asst. Operations : Cpt. Y. Boyer	1 Boeing S-307 3 Douglas DC-3 1 Beechcraft C-45 1 Consolidated Vultee Valiant (BT-13)	784	124,965 *81,613*	16,581	72,895	58,112	All commercial air traffic in Haiti is operated by the Corps d'Aviation de l'Armée d'Haiti.
HAWAIIAN ISLANDS								
Hawaiian Airlines, Ltd.	Inter-Island Building, Honolulu 1, Hawaii President : S. C. Kennedy	5 Convair 340 10 Douglas DC-3	402	3,115,211 *20,145*	385,285 *2,602*	549,962	21,272,366 *21,333*	—

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Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
HAWAIIAN ISLANDS—*cont.*								
Trans-Pacific Airlines Ltd. (T.P.A. Aloha Airline)	P.O. Box 3769, Honolulu President : R. F. Tongg Exec. Vice-Pres : D. A. Benz Ops. Manager : O. U. Andrew	6 Douglas DC-3	1,007	1,573,719 *2,947*	172,994 *445*	152,131	1,521,927	—
HONDURAS								
Services Aereo de Honduras S.A. (SAHSA)	Avenida Colon y Cuarta Calle, Tegucigalpa, D.C. President : Carlos Izaguirre Gen. Manager : Raul Zelaya R.	7 Douglas DC-3	2,644	—	—	—	—	Pan American World Airways has 40% interest.
Transportes Aereos Nacionales S.A. (T.A.N.)	Edificio Marichal Tegucigalpa, D.C. President : Miguel Brooks Gen. Manager : Miguel Brooks h.	2 Curtiss Commando	1,180	—	—	—	—	—
HONG KONG								
Cathay Pacific Airways, Ltd.	No. 1 Connaught Road, Central, Hong Kong Chairman : J. A. Blackwood Man. Director : W. C. G. Knowles	1 Douglas DC-4 2 Douglas DC-3 *On order :* 1 Douglas DC-6	8,991	1,317,369	18,687	160,799	1,083,865	—
Hong Kong Airways, Ltd.	18, Pedder Street Hong Kong Chairman : H. D. M. Barton	1 Douglas DC-4 *On order :* 2 Vickers Viscount 700D	550	183,700	7,454	—	670,056 (includes mail)	Operated by Jardine, Matheson & Co., Ltd. as a private company with routes to Formosa using chartered aircraft.
HUNGARY								
Magyar Légikoz lekedési Vállalat (Hungarian Air Transport "Maléu")	V. Vörösmarty-Tér 5, Budapest	10 LI-2	1,848	—	—	—	—	State-owned.
ICELAND								
Flugfelag Islands H.F. (Iceland Airways)	Reykjavik Airport, Reykjavik Gen. Manager : Ö. O. Johnson	2 Douglas DC-4 4 Douglas DC-3 2 Convair Catalina 1 Grumman Goose	7,078	1,056,329	54,008	330,905	2,190,704	—
Loftleidir H.F. (Icelandic Airlines)	Lækjargata 2, Reykjavik Chairman : K. Guolauesson Gen. Manager : A. Elíasson	2 Douglas DC-4 (1 on charter)	5,711	933,441	11,000	54,426	297,575	—
INDIA								
Air India International Corporation	New India Assurance Building, Mahatma Gandhi Road, Bombay 1 Chairman : J. R. D. Tata Gen. Manager : B. K. Patel Ops. Manager : A. C. Gazdar	3 Lockheed Constellation 5 Lockheed Super Constellation *On order :* 1 Lockheed Super Constellation	15,326	3,373,000 *248,000*	39,100 *1,700*	604,000	2,118,000 *18,000*	Nationalised Aug. 1, 1953.
Indian Airlines Corporation	Mandi House, New Delhi	—	—	—	—	—	—	A nationalised company formed on Aug. 1, 1953, by merging of all Indian domestic carriers.
INDONESIA								
Garuda Indonesian Airways N.V.	Djalan Nusantara 15, Djakarta Acting President : Dr. M. Soetoto	8 Convair 340 8 Convair 240 15 Douglas DC-3 14 D.H. Heron	20,505	7,700,493 *651,587*	309,541 *4,882*	4,546,859	30,150,331	State-owned from March, 1954.
IRAN								
Iranian Airways Company	Avenue Saadi, Teheran Man. Director : Reza Afshar Ops. Manager : Roger Fay	2 Douglas DC-4 7 Douglas DC-3 1 D.H. Dove 1 Beechcraft D18S 1 Fairchild Argus	4,284	797,963	24,901	12,978	578,323	Company under 5-year management contract with Transocean Air Lines, Oakland, California.
IRAQ								
Iraqi Airways	Baghdad West, Baghdad Manager : Col. Sabah El Said Tech. Adviser : A. D. Bennett, A.F.C.	4 Vickers Viking 1 D.H. Dove *On order :* 3 Vickers Viscount	2,987	842,299 *127,252*	37,090 *2,185*	122,791	734,022 *5,750*	State-owned.
IRELAND								
Aer Lingus, Teoranta	43, Upper O'Connell Street, Dublin Chairman : P. Lynch Gen. Manager : J. F. Dempsey	4 Vickers Viscount 707 12 Douglas DC-3 4 Bristol Freighter	3,747	3,592,718 *167,408*	324,437 *4,409*	3,377,178	9,362,338 *2,506,130*	Aer Rianta has 60% interest on behalf of Irish Government. B.E.A. holds remaining 40%.

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ISRAEL								
El-Al Israel Airlines Ltd.	76, Maze Street, Tel-Aviv Man. Director : L. A. Pincus Ops. Manager : M. Lang	3 Lockheed Constellations 6 Curtiss Commando *On order :* 3 Bristol Britannia 300	15,273	2,664,850 *14,700*	30,277 *2,511*	281,508	1,682,036	State owns 63% and Public Institutions 37%: Has 50% interest in "Arkia."
Israel Inland Airlines Ltd. (ARKIA)	70, Achad Haam Street, Tel Aviv Man. Director : J. Hozman Ops. Manager : A. Luria	1 Curtiss Commando 1 D.H. Rapide *On order :* 2 Douglas DC-3	186	624,477	10,463	4,482	718,475	—
ITALY								
Aerolinee Italiane Internazionali (Alitalia)	Via Leonida Bissolati, 20, Rome Gen. Manager : Bruno Velani Ops. Manager : Mario Ceroni	4 Douglas DC-6B 1 Douglas DC-4 4 Convair 340 *On order :* 2 Douglas DC-6B	22,980	3,778,498	—	1,037,402 tonne-kms.	765,702 tonne-kms.	Jointly owned by the Italian Ministry of Finance (60.65%), Italian Citizens (9.35%) and B.E.A. (30%).
Linee Aeree Italiane S.p.A. (L.A.I.)	Via Del Tritone 132, Rome President : Prince Marcantonio Pacelli Director General : General Luigo Gallo Comm. Manager : Dr. R. Naselli	2 Douglas DC-6B 3 Douglas DC-6 4 Convair 240 14 Douglas DC-3	22,939	5,983,848 *22,038*	186,206 *473*	2,136,870	5,874,109 *511*	—
JAPAN								
Japan Air Lines Co., Ltd. (Nippon Koku K.K.)	Tokyo Building, 2-Chome, Marunouchi, Chiyoda-Ku, Tokyo. President : Seijiro Yanagita Man. Director : Shizuma Matsuo	5 Douglas DC-6B 7 Douglas DC-4 3 D.H. Heron 2 Beechcraft D-18 *On order :* 2 D.H. Comet	8,803	4,171,800 *59,237*	279,297 *549*	1,459,722 *498*	1,714,087	—
JORDAN								
Air Jordan Co.	Salt Road, P.O. Box 274, Amman Gen. Manager : S. R. Kochenderfer	3 Douglas DC-3 1 D.H. Rapide *On order :* 1 Curtiss C-46	—	377,936 *97,511*	26,630 *6,658*	20,121	831,109	—
Arab Airways (Jerusalem) Ltd.	King Faisal Street, Amman Chief Executive : J. Linstead Manager : Wadi Salameh	3 Douglas DC-3	2,804	399,500 *69,750*	19,600 *2,740*	39,485	470,246	The National Airline of Jordan. In association with B.O.A.C.
KOREA								
Korean National Airlines	No. 8, 2nd KA., Chsong-Ang-Dong, Pusan President : Y. W. Shinn Gen. Manager : John Surk	Douglas DC-3	—	—	—	—	—	Operates from Pusan in association with Civil Air Transport, Inc.
LEBANON								
Air Liban	Place Assour, Esseily Building, Beirut President : G. Karam Director General : B. Meguerdiche	2 Douglas DC-4 4 Douglas DC-3 2 Languedoc 161 *On order :* 1 Douglas DC-4	7,351	1,207,515	38,318	49,750	1,764,150	Air France has 33⅓% interest.
Mideast Aircraft Service Co. (Masco)	Beirut	—	—	—	—	—	—	Jointly owned and operated by B.O.A.C., Hunting-Clan and Skyways. Provides aircraft, maintenance and training facilities for Middle East carriers.
Société des Lignes Aériennes pour le Moyen-Orient, S.A. (Middle East Airlines)	Beirut President : H. E. Sa'eb Bey Salaam Gen. Manager : Sheiken Najib Alamuddin Ops. Manager : S. A. Salaam	7 Douglas DC-3	8,583	1,459,706 *593,531*	39,529 *6,249*	101,946 *2,410*	1,368,352 *806,471*	—
LIBERIA								
Liberian National Airways	Robertsfield Airport, Terminal, Harbel President : F. H. Syphert	3 Douglas DC-3	996	—	—	—	—	—
MALAYA								
Federation Air Service	Airport, Kuala Lumpur	5 D.H. Beaver	674	310,000	7,367	—	11,000	Government owned. Managed on behalf of the Dept. of Civil Aviation by the Malayan Railway.
Malayan Airways, Ltd.	Ocean Building, Collyer Quay, Singapore 1 Managed by : Mansfield & Co. Ltd. Man. Director : R. P. Mollard Manager : J. Skeldon	11 Douglas DC-3 2 D.H. Rapide	5,130	2,744,021	109,890	1,022,813	7,724,301	Sabah Airways Ltd. is a wholly-owned subsidiary. An associate of B.O.A.C.

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MALTA								
The Malta Airlines	285, Kingsway, Valetta Chairman : Lt. Col. R. G. Strickland Gen. Manager : J. T. Crossey	—	—	—	—	—	—	Incorporates Malta Airways Co. Ltd. and Air Malta Co. Ltd. Services operated by B.E.A.
MEXICO								
Aeronaves de Mexico S.A. (AMSA)	Mariano Escobedo Num. 543, México, D.F. President : A. D. Lombardo Gen. Manager : C. Ramos	2 Douglas DC-4 4 Convair 340 18 Douglas DC-3 *On order :* 1 Douglas DC-4	8,327	6,043,994 *1,257,381*	405,214 *5,321*	803,903	7,141,068	Figures include those of Aerovias Reforma which was bought in 1954. An affiliate of Pan American World Airways.
Aero Transportes S.A. (A.T.S.A.)	Av. Juarez No. 117-A, Mexico, D.F. Gen. Manager : H. J. Filsinger	—	2,481	—	—	—	—	Operates in conjunction with Compañiá Mexicana de Aviación S.A., from whom aircraft are leased. Combines the resources of Aerovias Latino-Americanos S.A., Aerovias Transcontinentales S.A. and Transportes Aereos de Jalisco S.A.
Aerovias Guest S.A.	Paseo de la Reforma 95, Mexico D.F. President Winston Guest Ops. Manager : D. G. Ruchardson	3 Douglas DC-4 *On order :* 2 Douglas DC-4	5,756	—	—	—	—	—
Aerovias Reforma S.A. (Reforma)	Aeropuero Central, Apartado Postal 9648, Mexico, D.F.	—	3,760	—	—	—	—	Bought by Aeronaves, 1954
Compañiá Mexicana de Aviación S.A. (C.M.A.)	Balderas 36, Mexico City President : A. Saenz Gen. Manager : E. R. Silliman Ops. Manager : M. H. Jones	4 Douglas DC-6 5 Douglas DC-4 1 Douglas C-54 15 Douglas DC-3 4 Douglas C-47	5,357	11,470,861 *1,440,751*	416,758	1,336,471	28,924,469	An affiliate of Pan American World Airways.
Lineas Aéreas Mexicanas S.A. (L.A.M.S.A.)	—	—	—	—	—	—	—	Bought by Aeronaves, 1954.
Trans Mar de Cortés S.A.	Avenida 16 De Septiembre No. 106, La Paz, Baja, California Man. Director Mayo Obregon T. Gen. Manager : Luis Coppola B.	3 Douglas DC-3 1 Cessna T-50	6,500	582,220 *5,821*	17,104 *168*	946,808	885,315 *206,104*	—
Transportes Aereos Mexicanos S.A. (T.A.M.S.A.)	Calle 62 No. 518, Mérida, Yucatan President : Arturo P. G. Canton Man. Director P. A. J. V. Hernández	2 Douglas DC-3 1 Douglas C-47 2 Boeing B-24J	1,248	515,649	6,757	165,566	6,052,832	—
NETHERLANDS								
Koninklijke Luchtvaart Maatschappij N.V. (K.L.M. Royal Dutch Airlines)	Plesmanweg 1, The Hague President : I. A. Aler	12 Lockheed L1049 10 Lockheed L749 6 Douglas DC-6 6 Douglas DC-6B 2 Douglas DC-6A 9 Douglas DC-4 15 Douglas DC-3 14 Convair 340 7 Convair 240 *On order :* 4 Lockheed L-1049G 2 Fokker F-27 10 Douglas DC-7C 9 Vickers Viscount 803	132,400	30,115,200 *2,601,400*	540,110 *27,930*	4,597,500 *4,400*	34,864,500 *699,300*	State holds 96% interest.
NETHERLANDS WEST INDIES								
Koninklijke Luchtvaart Maatschappij N.V. (K.L.M. Royal Dutch Airlines, West Indies Division)	Curaçao Netherlands Antilles Gen. Manager : V. H. L. Du Bourcq	4 Convair 340 6 Douglas DC-3	12,500	2,758,900 *98,500*	110,781 *4,105*	356,000 *3,300*	4,321,600 *49,400*	—
NEW GUINEA								
Gibbes Sepik Airways, Ltd.	Goroka, T.N.G. Man. Director : V. H. Gibbes Gen. Manager : V. W. Cox	8 Noorduyn Norseman	5,546	— *317,130*	— *11,620*	— *65,477*	— *3,308,378*	—

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Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
NETH. W.I.—*cont.*								
Mandated Airlines Ltd.	Lae Man. Director : J. B. Sedgers Manager : H. J. Hindwood	2 Douglas DC-3 3 D.H. Dragon *On order :* 1 Douglas DC-3	1,773	320,000 *128,000*	21,331	179,436	4,222,440	—
NEW ZEALAND								
New Zealand National Airways Corporation (N.Z.N.A.C.)	P.O. Box 96, Aotea Quay, Wellington Gen. Manager : J. J. Busch, O.B.E. Ops. Manager : H. C. Walker, M.V.O.	22 Douglas DC-3 4 D.H. Heron 6 D.H. Rapide	3,947	5,717,611	379,079	1,029,391	11,350,964	—
Tasman Empire Airways, Ltd. (TEAL)	P.O. Box 2201, Auckland Chairman : Sir Leonard M. Isitt Gen. Manager : G. N. Roberts	3 Douglas DC-6 2 Short Solent	9,564	1,932,944	43,272	808,816	757,969	Jointly owned by Governments of New Zealand (50%) and Australia (50%). On April 1, 1954, absorbed B.C. P.A.'s routes to Australia and Fiji.
NICARAGUA								
Lineas Aéreas de Nicaragua, S.A. (La Nica)	Managua, D.N. Gen. Manager : F. F. Amador Ops. Manager : C. Vanegas	7 Douglas DC-3 1 Howard DGA	1,546	809,965	27,110	978,171	23,167,186	Pan American World Airways has a 20% interest. Nicaraguan Government has a 10% interest.
Transportes Aereos Nicaraguenses	Managua	Douglas DC-3	—	—	—	—	—	—
NORWAY								
Braathen's South-American and Far-East Air Transport A/S. (S.A.F.E.)	Fr. Nansens Plass 7, Oslo President : L. G. Braathen	2 Douglas DC-4 1 Douglas DC-3 3 D.H. Heron *On order :* 1 Vickers Viscount 700D	1,000	431,570 *486,225*	23,941 *3,277*	187,962 *2,658*	151,883 *225,871*	Operates to Far East on charter.
Det Norske Luftfartselskap A/S. (D.N.L.)	Oslo Chairman : Per M. Hansson President : O. Steen	—	—	—	—	—	—	A non-operating company in the S.A.S. Consortium. See under "Scandinavia."
Vestlandske Luftfartselskap A/S. (West Norway Airlines)	Bergen President : J. Horn Director : S. Liby	2 Short Sealand 3 Republic Seabee *On order :* 1 Prestwick Twin Pioneer	988	228,979 *70,517*	8,869 *808*	170,785	13,918 *57,005*	—
Wideroe's Flyveselskap og Polarfly A/S.	Kr. Augustsgt 19, Oslo Gen. Manager : V. Wideröe	2 Noorduyn Norseman 1 D.H. Otter	—	175,983	5,612	77,563	17,549	—
PAKISTAN								
Orient Airways, Ltd.	Karachi Gen. Manager : M. M. Salim Ops. Manager: A. Husain	2 Convair 240 11 Douglas DC-3	3,682	1,441,301 *347,359*	60,703 *4,933*	309,184 *1,944*	1,358,283 *3,447,878*	Merged with Pakistan International Airlines March 11, 1955.
Pakistan International Airlines Corporation	Karachi Chairman : M. A. Ispahani Gen. Manager : F. M. McGregor Ops. Manager : N. Hemsworth	3 Super Constellation	5,858	249,348 *135,486*	9,758 *1,923*	112,157 *2,083*	594,388 *19,914*	Government-owned. Began scheduled services May, 1954. Since March 11, 1955, incorporates Orient Airways.
PANAMA								
Compania Panamena de Aviacion S.A. (C.O.P.A.)	Avenida Peru 25, Panama R.P. President : Ricardo Arias, Jr. Gen. Manager : R. A. Norton	6 Douglas DC-3	542	—	—	—	—	Pan American World Airways has a 33% interest.
PERU								
Compañia de Aviacion Faucett S.A.	Jiron Union 926, Hotel Bolivar, Lima President : E. Dibos D. Man. Director : A. Bentin M.	4 Douglas DC-4 7 Douglas DC-3 4 Faucett-Stinson	5,267	2,591,090	132,840	355,733	27,609,989	—
Grupo de Transportes	1414, Limatambo Airport, Lima Director : Col. C. Ramos	8 Douglas DC-3 6 D.H. Rapide 4 D.H. Beaver 1 Beechcraft 4 Convair Catalina 3 Stinson	—	—	—	—	—	Operated by the Peruvian Air Force.
PHILIPPINES								
Philippine Air Lines, Inc. (P.A.L.)	M.R.S. Building, Plaza Cervantes, Manila President : Col. A. Soriano Ops. Manager : D. P. Thurber	3 Convair 340 29 Douglas DC-3 4 Curtiss Commando 2 Hiller 360 Helicopter	—	—	—	—	—	Operates regional and domestic services in S.E. Asia.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
POLAND								
Polskie Linie Lotnicze (LOT)	Ul Hoza 39, Warsaw Gen. Manager: Sergiusz Minorski	IL-14 IL-12 LI-2 Douglas C-47 Aero 45	—	2,386,000	135,359	196,100 tonne-kms.	765,700 tonne-kms.	—
PORTUGAL								
Transportes Aéreos Portugueses (T.A.P.)	Rua Braamcamp No. 2. Lisbon Chairman: D. Francisco de Mello e Castro Ops. Manager: Roger de Avelar	—	8,838	1,367,607 *8,943*	27,310	237,438	262,213	Formerly state-owned. Became a private concern, June 1, 1953.
PORTUGUESE AZORES								
Sociedade Açoriana de Transportes Aéreos Lda. (S.A.T.A.)	Rua des Mercadores 7-11 Ponta Delgada, S. Miguel President: A. M. S. Nogueira	2 D.H. Dove	224	—	—	—	—	Operates inter-island services.
PORTUGUESE EAST AFRICA								
Divisão de Exploração dos Transportes Aéreos (DETA)	103, Rua Araujo, P.O. Box 276, Lourenço Marques Moçambique Director General: A. P. Pereira Leite Gen. Manager: A. H. Pinho da Cunha Ops. Manager: C. B. Delgado, Jr.	3 Douglas DC-3 6 D.H. Dove 3 Lockheed Lodestar 2 Junkers Ju-52/3 4 D.H. Rapide	2,639	1,214,463 *75,727*	16,245	160,417	475,965	State-owned.
PORTUGUESE TIMOR								
Transportes Aéreos de Timor (T.A.T.)	Dili Airport, Timor Manager: F. L. V. A. Cardoso Dias	2 D.H. Dove	560	—	—	—	—	Owned by Portuguese Government.
PORTUGUESE WEST AFRICA								
Divisão de Exploração dos Transportes Aéreos (D.T.A.)	Rua Pereira Forjaz P.O. Box 79, Luanda Man. Director: Maj. J. da Silva Medina Ops. Manager: Francisco Branco	4 Douglas DC-3 1 Douglas C-47 4 Beechcraft D-18S 7 D.H. Dragon Rapide	5,608	930,503 *106,574*	24,981 *1,061*	203,568	977,807 *46,978*	Government controlled.
Serviço de Transportes Aéreos (S.T.A.)	Aero Porto Salazar, S. Tomé	2 D.H. Rapide 1 Auster Autocar	350	—	—	—	—	—
PUERTO RICO								
Caribbean-Atlantic Airlines, Inc. (Caribair)	San Juan, Puerto Rico President: Dionisio Trigo Vice-President (Ops): José M. Sierra	3 Douglas DC-3	393	700,472	121,078	—	—	—
RUMANIA								
Transporturi Aeriene Romine (TAROM)	Aeroportul Baneasa, Bucuresti	—	—	—	—	—	—	—
SAUDI ARABIA								
Saudi Arabian Airlines	Jedda Director General: Maj. Gen. I. Tassan Ops.Superintendent: S. H. Wheatley	4 Convair 340 5 Douglas DC-4 13 Douglas DC-3 5 Bristol Wayfarer *On order:* 6 Convair 340	3,000	—	—	—	—	Government-owned. Managed by T. W. A. Traffic figures kept by Government and not published.
SCANDINAVIA								
Scandinavian Airlines System (S.A.S.)	Bromma Airport, Stockholm 40 President: Henning Throne-Holst Exec. Vice-Pres.: Sven Östling	14 Douglas DC-6B 12 Douglas DC-6 4 Douglas DC-4 10 Douglas DC-3 7 Saab Scandia 2 Junkers Ju-52 *On order:* 8 Douglas DC-7C 1 Saab Scandia	81,399	21,793,449	758,375	9,134,607	20,852,075	—
SOUTH AFRICA								
Commercial Air Services (Pty.) Ltd. (Comair)	Second Floor, Balgownie House, Commissioner St., Johannesburg Directors: J. M. S. Martin L. Zimmerman Sir Archibald Hope	2 Lockheed Lodestar 5 Cessna 170	693	—	—	—	—	An associate of Airwork Ltd. London. Has 54% interest in commercial Air Services (Rhod.) (Pty.) Ltd. Commercial Air Services Natal (Pty.) is a wholly-owned subsidiary.
South African Airways (S.A.A.)	Jan Smuts Airport, Kempton Park Chief Airways Manager: Maj. Gen. C. J. Venter	4 Lockheed Constellation 7 Douglas DC-4 5 Douglas DC-3 9 Lockheed Lodestar *On order:* 3 Douglas DC-7B	24,485	6,809,016	217,899	3,016,236	2,420,276	State-owned.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
SOVIET UNION								
Glavnoe Upravienie Grazhdanskogo Flota (Aeroflot)	Hotel Metropol, Sverdlov Square, Moscow President: Marshal S. F. Zhavoronkov Ops. Director: Piotr Eromassov	IL-18 IL-12 LI-2 YaK-16 Shch E-2	—	—	—	—	—	Total fleet strength is said to be more than 400 aircraft.
SPAIN								
Aviacion y Comercio S.A. (Aviaco)	Aduana 33, Madrid Man. Director: D. Jose Pazo Montes	3 S.E. 161 Languedoc 6 Bristol Freighter	7,495	—	—	—	—	—
Compañia Mercantil de Lineas Aéreas Españolas (Iberia)	Avenida de América 2, Madrid President: J. R. Paz Gen. Manager: C. G. Lucia	3 Lockheed Constellation 749 16 Douglas DC-3 6 Douglas DC-4 4 Bristol Freighter 1 Junkers Ju-52 1 D.H. Rapide	42,897	8,193,755 *109,456*	519,660 *2,324*	1,572,503 *1,738*	2,580,420 *15,816*	—
SUDAN								
Sudan Airways	Gaon Building, P.O. Box 253, Sirdar Avenue, Khartoum Gen. Manager: A. B. Mohd Ops. Manager: R. L. C. Branson	4 D.H. Dove 4 Douglas DC-3 *On order:* 1 Douglas DC-3	4,183	845,839 *97,841*	20,488 *1,092*	64,809 *1,221*	638,485 *16,618*	A department of the Sudan Government.
SWEDEN								
Aktiebolaget Aerotransport (A.B.A.)	Bromma Airport Stockholm 40 Chairman: Axel Gjöres President: Karl Lignell	—	—	—	—	—	—	A non-operating company in the S.A.S. consortium. See under "Scandinavia."
SWITZERLAND								
Schweizerische Luftverkehr A.G. (Swissair)	Hirschengraben 84, Zurich President: Dr. W. Berchtold	6 Douglas DC-6B 7 Convair 240 3 Douglas DC-4 13 Douglas DC-3 *On order:* 2 Douglas DC-7C	33,227	10,942,405 *117,187*	540,085 *4,753*	6,399,877 *12,674*	13,195,347 *228,804*	State holds 30% interest. Swissair Photo Ltd. is a wholly-owned subsidiary.
SYRIA								
Syrian Airways	Fardoss Street, Damascus Gen. Manager: Capt. M. Khani	5 Douglas DC-3	—	764,320	32,021	—	477,892	—
THAILAND								
Thai Airways Company Ltd. (T.A.C.)	6, Larn Luang Road, Bangkok Man. Director: A. V. M. M. R. Sukshom Kashemsanta	2 Douglas DC-4 5 Douglas DC-3 4 Noorduyn Norseman 2 Beechcraft Bonanza *On order:* 2 Lockheed Super Constellation	7,700	1,835,502 *107,322*	47,910 *3,134*	1,563,699 *47,031*	802,392 *1,955*	Government hold 95% of capital.
TURKEY								
Devlet Hava Yollari (D.H.Y.)	Genel Müdürülk, Ankara Gen. Manager: Riza Cerçel Ops. Manager: Suphi Iscen	26 Douglas DC-3 7 D.H. Heron	15,135	—	—	—	—	State-owned.
URUGUAY								
Compània Aeronautica Uruguaya S.A. (Causa)	Calle Colonia 1068, Montevideo President: J. Americo Beisso Man. Director: Col. Tydeo L. Borges	3 Short Sandringham	154	—	—	—	—	—
Primeras Lineas Uruguayas de Navigacion Aerea (P.L.U.N.A.)	Calle Uruguay, 1107, Montevideo President: General Pedro Sicco Gen. Manager: Delfin Diaz Cibils	6 Douglas DC-3	2,022	—	—	—	—	—
U.S.A.								
Aerovias Sud Americana, Inc. (ASA International Airlines)	Pinellas International Airport, St. Petersburg, Florida President and Gen. Manager: V. V. Carmichael, Jr. Vice-President (Ops.): H. C. Palmer	5 Curtiss Commando	2,650	1,723,647	—	—	9,700,000	Operates a freight service to Belize, Bogota, El Salvador, Guatemala, Havana and Panama.
Allegheny Airlines Inc.	Hangar 12, Washington National Airport, Washington 1, D.C. President: L. O. Barnes	15 Douglas DC-3	2,198	4,011,316 *36,134*	272,723 *4,110*	1,039,937	1,947,338	—
Alpena Flying Service, Inc.	Phelps Collins Airport, Rte. 2, Alpena, Michigan President: R. C. Welch	2 Cessna 195	400	—	—	—	—	Operates summer schedule between Alpena and Detroit.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
U.S.A.—*cont.*								
American Airlines, Inc.	100, Park Avenue, New York 17 President: C. R. Smith Vice-President (Ops.): O. M. Mosier	75 Douglas DC-6 3 Douglas DC-6A 76 Convair 240 9 Douglas DC-4 25 Douglas DC-7 *On order:* 14 Douglas DC-7 4 Douglas DC-6A 35 Lockheed Electra	10,825	3,456,686,000 pass. miles	5,886,000	16,715,000 ton-miles	58,000,000 ton-miles	American Airlines de Mexico, S.A. is a wholly-owned subsidiary.
Baca Airlines System	Memorial Airport, P.O. Box 831, Jefferson City, Mo. President: J. Raymond Brummet	6 Stinson Reliant 3 Cessna T-50 3 Beech Bonanza 4 Cessna 195 3 Cessna 170	1,064	—	—	—	—	—
Bonanza Air Lines, Inc.	P.O. Box 391, Las Vegas, Nevada President: Edmund Converse Exec. Vice-Pres.: G. Robert Henry Vice-President (Ops): M. W. Reynolds	5 Douglas DC-3 *On order:* 4 Douglas DC-3	1,438	1,698,910 *6,898*	75,655 *495*	273,931	549,430	—
Braniff Airways, Inc.	Love Field, Dallas 9, Texas President: C. E. Beard Ops. Manager: R. V. Carleton	9 Douglas DC-6 26 Convair 340 23 Douglas DC-3 *On order:* 7 Douglas DC-7C	15,557	26,564,863 *171,682*	1,498,158	10,754,000	21,624,000	—
California Central Airlines, Inc.	Lockheed Air Terminal, Burbank, California President: C. C. Sherman	5 Martin 404 2 Douglas DC-3 1 Lockheed 12-A	481	—	—	—	—	—
Capital Airlines, Inc.	Washington 1, D.C. President: J. H. Carmichael Vice-President (Ops.): J. B. Franklin	12 Lockheed Constellation 25 Douglas DC-4 23 Douglas DC-3 3 Vickers Viscount *On order:* 57 Vickers Viscount	5,160	29,485,377	2,426,961	3,644,822 ton-miles	7,090,046 ton-miles	—
Central Airlines, Inc.	Meacham Field, Fort Worth, Texas President: K. Kahlo Exec. Vice-President: F. E. Howe	9 Douglas DC-3	2,281	1,845,755 *5,684*	58,978 *231*	641,530	687,661	—
Colonial Airlines, Inc.	230, Park Avenue, New York 17, N.Y. President: B. T. Dykes	5 Douglas DC-4 8 Douglas DC-3	3,013	5,182,286 *61,773*	434,446 *2,442*	1,220,592	2,980,386	—
Continental Air Lines, Inc.	Stapleton Airfield, Denver 5, Colorado President: R. F. Six Vice-President (Ops.): O. R. Haueter	3 Douglas DC-6B 6 Convair 340 19 Douglas DC-3	3,095	8,003,921 *49,763*	415,860 *1,370*	3,080,983	5,152,894	Merged with Pioneer Air Lines, April 1, 1955
Delta Air Lines, Inc.	Atlanta, Georgia President and Gen. Manager: C. E. Woolman	7 Douglas DC-7 6 Douglas DC-6 3 Lockheed Constellation 20 Convair 340 16 Douglas DC-3 *On order:* 3 Douglas DC-7	10,318	31,495,029 *62,449*	1,830,015	14,699,180	35,618,980	Operates as Delta C. & S. Air Lines
Eastern Air Lines, Inc.	10, Rockefeller Plaza, New York 20, N.Y. President: T. F. Armstrong Vice-President (Ops.): S. L. Shannon	29 Lockheed Super Constellation 60 Martin 404 19 Lockheed Constellation 10 Douglas DC-4 *On order:* 12 Douglas DC-7	12,744	86,814,484 *416,830*	5,783,974 *19,048*	25,562,000	38,360,220	—
The Flying Tiger Line, Inc.	Lockheed Air Terminal, Burbank, California President: R. W. Prescott Vice-President (Ops.): W. E. Bartling	2 Douglas DC-6A 4 Douglas DC-6B 7 Douglas DC-4 26 Curtiss Commando *On order:* 1 Douglas DC-6A	4,853	4,993,125 *8,711,183*	—	—	36,026,600	Non-scheduled freight carrier.
Frontier Airlines, Inc.	Stapleton Airfield, Denver 5, Colorado, President: C. A. Myhre	12 Douglas DC-3	3,647	4,409,211 *54,648*	145,579 *7,678*	1,236,365	3,345,285	—
Helicopter Air Service, Inc.	5036, West 63rd Street, Chicago 38, Illinois President: T. Hamil Reidy Vice-President (Ops.): C. W. Moore	6 Bell 47-D 1 Bell 47-D1	350	336,202 *51,660*	—	3,181,960	—	Operates helicopter mail services in Chicago area.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
U.S.A.—*cont.*								
Lake Central Airlines, Inc.	Weir Cook Municipal Airport, Indianapolis, Indiana President: G. Hicks Vice-President (Ops.): R. W. Clifford	7 Douglas DC-3	1,745	1,806,372 *21,241*	79,673 *1,084*	31,843 ton-miles	95,873 ton-miles	—
Los Angeles Airways, Inc.	5901, W. Imperial Highway, Los Angeles 45, California	3 Sikorsky S-51 4 Sikorsky S-55	325	343,338	211	6,126,440	686,516	Operates scheduled passenger, mail and express helicopter services in Los Angeles area.
Massachusetts Air Industries	Municipal Airport, New Bedford, Massachusetts Manager: A. A. Dessert	2 Ryan Navion 12 Cessna T-50 2 Cessna 140 2 Cessna 170	—	— *75,000*	— *850*	—	— *216,000*	—
Mohawk Airlines, Inc.	Cornell University Airport, Ithaca, New York President: R. E. Peach Vice-President (Ops.): C. A. Benscoter	10 Douglas DC-3 1 Sikorsky S-55 *On order:* 3 Convair 240	1,181	3,002,104 *59,344*	218,288 *4,276*	532,000	1,810,000	—
National Airlines, Inc.	3240, N.W. 27th Avenue, Miami 42, Florida President: G. T. Baker	4 Douglas DC-7 8 Douglas DC-6B 4 Douglas DC-6 10 Lockheed 18-50 12 Convair 340 1 Sikorsky S-55	2,829	22,598,589	1,074,704	8,527,186	16,601,487	—
New York Airways, Inc.	P.O. Box 426, La Guardia Airport Station, Flushing 71, New York President: R. L. Cummings, Jr. Ops. Manager: J. E. Gallagher	5 Sikorsky S-55 *On order:* 2 Sikorsky S-55	366	391,435 *9,942*	8,180 *578*	2,354,464	518,282 *528*	Operates scheduled helicopter services in New York area.
North Central Airlines, Inc.	6201, 34th Avenue South, Wold-Chamberlain Field, Minneapolis 23, Minn. President and Gen. Manager: H. N. Carr Chairman: A. E. A. Mueller	18 Douglas DC-3	2,399	5,202,856 *107,194*	283,556	1,457,594	2,587,254	—
Northeast Airlines, Inc.	Logan International Airport, 239, Prescott St., East Boston, Mass. Chairman: Paul F. Collins President: George E. Gardner Vice-President (Ops.): A. A. Lane	7 Convair 240 12 Douglas DC-3	3,048	104,226,881 pass. miles	523,489	145,769 ton-miles	470,463 ton-miles	—
Northwest Airlines, Inc.	1885, University Avenue, St. Paul 1, Minnesota President: D. W. Nytop Exec. Vice-Pres.: M. S. Mackay Vice-President (Ops.): F. C. Judd	10 Boeing Stratocruiser 7 Douglas DC-6B 18 Douglas DC-4 7 Douglas DC-3 *On order:* 4 Lockheed 1049G 3 Douglas DC-6B	17,838	27,029,860	1,199,193	6,990,462 ton-miles	12,970,109 ton-miles	Operates under popular name of Northwest Orient Airlines.
Ozark Air Lines, Inc.	P.O. Box 7, Lambert Field, St. Louis 21, Missouri President: L. Hamilton Ops. Manager: F. E. Myers	13 Douglas DC-3	2,669	2,911,000 *54,000*	153,815 *2,576*	105,836,000	165,780,000	—
Pacific Northern Airlines, Inc.	1626, Exchange Building, Seattle 4, Washington President: A. G. Woodley Vice-President (Ops.): J. A. Cunningham	5 Douglas DC-4 4 Douglas DC-3 *On lease:* 3 Lockheed L-649	4,489	3,386,798 *50,656*	75,950 *2,102*	2,610,595	7,496,000 *32,000*	—
Pan American-Grace Airways, Inc. (Panagra)	135, East 42nd Street, New York 17, N.Y. President: A. B. Shea Gen. Manager: D. Campbell Vice-President (Ops.): T. J. Kirkland	4 Douglas DC-6B 4 Douglas DC-6 3 Douglas DC-4 6 Douglas DC-3 *On order:* 5 Douglas DC-7	8,784	5,724,134 *75,079*	133,109 *739*	833,600	6,688,000 *32,000*	—

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
U.S.A.—*cont.* **Pan American World Airways, Inc.**	135, East 42nd Street. New York 17, N.Y. President : Juan T. Trippe Vice-Pres. (Admin.) : John C. Leslie	27 Boeing Stratocruiser 5 Convair 240 6 Lockheed Constellation 41 Douglas DC-6B 3 Douglas DC-6A 24 Douglas DC-4 6 Douglas DC-3 *On order :* 3 D.H. Comet 3 7 Douglas DC-7B 33 Douglas DC-7C	62,757	67,256,000	1,799,000	—	319,400,000 ton-miles (includes all cargo and mail)	—
Piedmont Aviation, Inc.	Winston-Salem, North Carolina President : T. H. Davis Vice-President (Ops.): H. K. Saunders	16 Douglas DC-3	2,931	6,216,823 *31,244*	308,194 *699*	1,165,245	2,398,160	—
Pioneer Air Lines, Inc.	Love Field, Dallas, Texas. President : Robert J. Smith Vice-President (Ops.): H. B. Seifert	10 Douglas DC-3	1,997	—	—	—	—	See Continental Air Lines, Inc.
Provincetown-Boston Airline Inc.	Municipal Airport, Provincetown, Massachusetts President : J. C. Van Arsdale	1 Lockheed Electra 2 Cessna T-50	45	75,600 *35,500*	5,055 *2,576*	5,985	19,795 *3,578*	Operates scheduled service between Boston and Cape Cod from May to September. Air taxi service remainder of year.
Resort Airlines, Inc.	P.O. Box 242, International Airport, Miami 48, Fla. President : W. Sternberg Vice-President (Ops.): Guy Tomberlin	7 Curtiss Commando 3 Douglas DC-4	—	—	—	—	—	—
Riddle Airlines, Inc.	International Airport, Miami, Florida President : J. P. Riddle Vice-President (Ops.): G. N. Tomberlin	8 Curtiss Commando	2,133	2,945,068 *149,701*	—	—	19,347,167 *1,019,531*	Scheduled all-cargo service between New York and Puerto Rico via Miami.
Slick Airways, Inc.	3,000, North Clybourn Avenue, Burbank, California Chairman : D. W. Rentzel Exec. Vice-President: G. M. Bain	3 Douglas DC-6A 12 Curtiss Commando	18,636	4,430,266 *353,763*	—	—	38,322,187	Non-scheduled freight carrier.
Southern Airways, Inc.	1140, Brown-Marx Building, Birmingham, Alabama President : F. W. Hulse	10 Douglas DC-3	2,120	—	—	—	—	—
Southwest Airways Company	San Francisco International Airport, California President : J. H. Connelly Exec. Vice-President: T. R. Mitchell	4 Martin 202 9 Douglas DC-3	1,153	2,254,673 *268,966*	180,715 *23,099*	1,109,534	1,532,703	—
Transocean Air Lines	Municipal Airport, Oakland 14, California President : Orvis M. Nelson Vice-President (Ops.): S. L. Wilson	Douglas DC-4 Curtiss Commando Lockheed Lodestar 3 Convair Catalina 3 Grumman Albatross	—	—	—	—	—	A non-scheduled carrier, but operates scheduled services in the Pacific Trust Territory (Mariana, Caroline and Marshall Islands) under contract to United Nations Trustee (U.S.A.).
Trans-Texas Airways	International Airport Houston 17, Texas President : R. E. McKaughan Vice-President (Ops.): H. E. Erdmann	16 Douglas DC-3	3,423	4,518,192 *12,117*	134,999 *399*	1,204,220	1,786,720	—
Trans-World Airlines, Inc. (T.W.A.)	10, Richards Road, Kansas City 5, Missouri Chairman : W. L. Pierson President : R. S. Damon	10 Lockheed L1049 27 Lockheed L749A 12 Lockheed L749 32 Lockheed L049 40 Martin 404 12 Martin 202A 11 Douglas DC-4 6 Douglas DC-3 *On order :* 20 Lockheed 1049G	33,000	87,473,780	3,593,910	33,072,611	63,768,423	—

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Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1954	Passengers 1954	Mail (lb.) 1954	Freight (lb.) 1954	Remarks
U.S.A. —*cont* **United Air Lines, Inc.**	5959, South Cicero Avenue, Chicago 38, Illinois President : W. A. Patterson Vice-President (Ops.): Otis E. Kline	25 Douglas DC-7 21 Douglas DC-6B 43 Douglas DC-6 55 Convair 340 10 Douglas DC-4 10 Douglas DC-4 (Freight) 17 Douglas DC-3 *On order :* 17 Douglas DC-7 21 Douglas DC-6B 5 Douglas DC-6A	13,250	98,331,000	4,784,000	23,701,000 ton-miles	44,735,000 ton-miles	—
Veteran Airways, Inc.	State Airport, Westerly, R.I. President : R. E. Lyon	1 Cessna T-50 6 various single-engined types	—	—	—	—	—	—
West Coast Airlines, Inc.	Boeing Field, Seattle 8, Washington President : Nick Bez Ops. Manager : George Cooke	12 Douglas DC-3	2,025	—	—	—	—	—
Western Air Lines, Inc.	6060, Avion Drive, Los Angeles International Airport, California President : T. C. Drinkwater Vice-President (Ops.): S. R. Shatto	8 Douglas DC-6B 6 Douglas DC-4 9 Douglas DC-3 9 Convair 240 *On order :* 5 Douglas DC-6B	5,525	15,842,000	834,910	6,566,000	8,552,000	—
Wyoming Skyways, Inc.	Box 219, Cheyenne Wyoming President : Lyle R. Rosendahl	2 Cessna 170 2 Cessna 120	—	—	—	—	—	—
VENEZUELA **Aerovias Venezolanas S.A. (Avensa)**	Edificio Banco Unión, Chorro a Dr. Diaz, Caracas President : H. L. Boulton Gen. Manager : Andres Boulton	3 Douglas DC-4 17 Douglas DC-3 *On order :* 3 Convair 340	3,872	—	—	—	—	—
Linea Aérea Taca de Venezuela C.A.	Conde a Carmelitas 13, Edificio Taca, Caracas President : L. A. Calderón Gen. Manager : L. Paúl	13 Douglas DC-3	2,699	1,886,208	144,706	12,205,164	—	A state-owned subsidiary of Línea Aeropostal Venezolana.
Linea Aeropostal Venezolana (L.A.V.)	Bloque 1, El Silencio, Caracas President : Luis A. Calderon Ops. Managers : A. J. Maldonado M. S. Mendoza	4 Lockheed Constellation 2 Martin 202 21 Douglas DC-3 2 Curtiss C-46 1 Lockheed Lodestar *On order :* 2 Lockheed Super Constellation 3 Vickers Viscount	19,693	—	—	—	—	State-owned. Linea Aérea Taca de Venezuela is a wholly-owned subsidiary.
Rutas Aereas Nacionales S.A. (Ransa)	Edificio America, Caracas Man. Director : Carlos Chavez Ops. Manager : K. F. Mitchell	8 Curtiss Commando 1 Douglas DC-3	—	—	—	—	—	—
VIETNAM **Air-Vietnam**	116, Boulevard Nguyen Hue, Saigon President : Nghiem Van Tri Man. Director : Ly Cong Trinh	3 Douglas DC-4 3 Douglas DC-3 5 Bristol Freighter	16,758	1,335,262 *1,864,744*	75,924 *69,671*	1,103,730 *230,243*	5,636,360 *13,729,890*	Vietnam Government has 50% interest. Other 50% held by Air France and local companies.
Société de Transports Aériens en Extreme-Orient (S.T.A.E.O.)	5-13, Rue Turc, Saigon Man. Director : Pham Hoe Director-General : M. Loubiere	4 S.O. 30P Bretagne 4 Douglas DC-3	—	1,654,352	90,600	—	13,862,663	—
YUGOSLAVIA **Jugoslovenski Aero-Transport (J.A.T.)**	P.O. Box 749, Bircaninova 1, Belgrade Gen. Manager : Ratomir Andjelkovic Ops. Manager : Miroslav Doufcar	13 Douglas DC-3 3 Convair 340	—	1,446,422 *249,132*	79,269	176,340 tonne-kms.	321,463 tonne-kms.	State-owned.

Non-scheduled traffic figures in italic type.

GUIDED MISSILES

D. A. KIMBALL
President, Aerojet-General Corporation.

THE years during and since World War II have brought a number of startling technological developments. One of the most revolutionary of these is the guided missile. A casual experiment in 1918 and virtually forgotten in the 20's and 30's, it has evolved into a vitally useful vehicle (and into an industry) since 1942. Only the great technical advances, notable in the fields of electronics and propulsion, make the high-performance research and tactical vehicles of to-day possible. Generally speaking, the need for such vehicles has always existed, for, certainly, superior weapons have always been desired by the men of the military services.

At the present time some knowledge is available on the guided missiles and the missile programme of the various nations. "Super weapons," or high-performance guided missiles, capable of carrying nuclear warheads are known to be under development by every major power.

Many such missiles are now, or are becoming, operational and yesterday's dreams of men of science and the military are rapidly being transformed into realities to ensure tomorrow's security—or a holocaust. But the guided missile, unlike the gun, offers promise of real service to mankind, and that is as a means of transportation. For while the guided missile is thought of as being an unmanned vehicle, the manned "ballistic" transports, satellites, and space ships of the future are destined to be outgrowths of actual and contemplated missile developments. Indeed, the test vehicles and research missiles of the present are daily gathering information that will be invaluable when man navigates the spaces beyond the earth's atmosphere as a commonplace medium of travel.

To come back to the cold reality of the present, we must accept that fact that all guided-missile programmes are military in nature and are either directly or indirectly devoted to destruction. Peaceful utilization of the technical skills which are developing and producing these weapons must seemingly be reserved for some future date, because at present the economic, intellectual, and material resources of all the major powers are otherwise committed.

To be useful to the military service, a tactical guided missile must be more than a masterpiece of technological development; it must be capable of being produced in quantities, it must be economical to produce, transport, service and launch, it must be readily handled, serviced, and launched by well-trained technicians, and the materials from which it is built must be available in sufficient quantities. Technologically, it must, of course, have a high degree of probability of properly

A Convair Terrier anti-aircraft guided missile leaving the deck of the converted battleship *Missisippi*. The Terrier will be the primary armament of the U.S. Navy's first two guided missile carriers, the U.S.S. *Boston* and U.S.S. *Canberra*. The U.S. Marine Corps has also adopted the Terrier as its first anti-aircraft missile for use in amphibious operations.

performing its mission. This requires a high degree of reliability; every component must not only function without failure but it must function within precise tolerances and at the proper time or in the proper sequence.

Certainly it becomes apparent that a guided missile is more than a mere flying machine. The major components of an advanced missile are composed of complex sub-components. The result is that industrially there are vast fields of endeavour which contribute materially to the success of a missile programme. There are, of course, the airframe manufacturers who must provide an efficient package for the containment of the other components. The airframe should be small in size and light in weight. It is the link between the brain of the missile and the surrounding atmosphere, and as such it is generally required to provide the means for controlling the trajectory. Structural engineers are needed to design the airframe to be strong enough; metallurgists and materials engineers are needed to supply materials with high strength, low weight, and great resistance to heating; aerodynamicists and designers must arrange the configuration to contain all the desired components and to perform properly in the surrounding media.

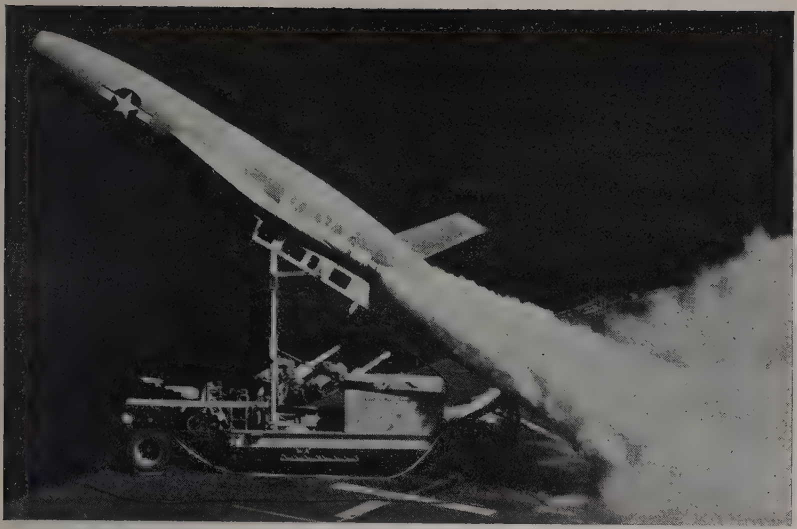
The pilot of an aeroplane must decide what he wants his craft to do and then cause it to do it through suitable manipulation of the controls. The guided-missile analogue of this gentleman is typically the seeker, the auto-pilot, and the actuation system. The field of electronics, or avionics, must provide the technology necessary for the electronic circuitry so essential to the functioning of all guided missiles. The engineers must provide the power and motion necessary to convert an electrical impulse into a mechanical response.

A Martin TM-61 Matador tactical missile leaving its mobile launcher under turbojet and booster-rocket power. Two Matador squadrons serving with the U.S. Forces in Western Germany were the first guided missile units to be deployed for service outside the United States.

Nike, a supersonic anti-aircraft missile, was the first combat-ready weapon of its type. Thirteen U.S. cities are provided with Nike anti-aircraft defences.

The power-plant of a missile must propel it at supersonic speeds. If the vehicle is offensive, high speed is needed to decrease its vulnerability; if it is defensive, high speed is needed to increase the probability of the missile intercepting its target. All high-performance guided missiles are jet-powered, whether by turbojet, turbojet-plus-afterburner, pulsejet, ramjet, rocket, hybrid jets, or combinations of these. The most commonly used engine in advanced guided missiles is the rocket, which has large propellant requirements but is light in weight, small in size, and independent of the atmosphere.

The modern turbopump-fed liquid-propellant rocket is not the simple pressure vessel and nozzle that idealized concepts would indicate. Rather, it is a complex assemblage of small rockets, turbines, pumps, valves, fluid passages, control units, sequence units, safety devices, and many other complexities that are electrical, electronic, hydrodynamic, aerodynamic, structural, metallurgical, chemical, mechanical, and servo-mechanical in nature, plus, of course, the thrust chamber itself. Certainly, it must be acknowledged that there are rockets which satisfy the concept of simplicity. Many solid-propellant rockets are simply a propellant grain contained in a cylindrical



A Chance Vought Regulus guided missile leaving a mobile launcher on the quarter deck of the U.S. Navy's guided missile test ship *Norton Sound.*

ship, or aircraft, equipment is required to handle and service the missile. Trucks, trailers, hoists, dollies are but a few of the items of equipment used for handling it. Servicing equipment varies widely and can be very extensive in nature and complexity.

The launcher can vary in its function as well as in its appearance. It may be simply two small fasteners placed below an aeroplane wing or it may be a large reinforced-concrete structure with passages to duct off exhaust gases, steel launching pads, and a huge movable gantry crane, plus a complexity of installed servicing equipment.

The control of a missile is frequently accomplished wholly or in part by a command system remote from the vehicle. This requires the transmission of information from the missile to the controller and from the controller to the missile, meanwhile accepting or obtaining knowledge of the geometric relationship between the missile and the target. All the while, it is necessary to predict what the missile should do next so that the appropriate command can be given. It quickly becomes apparent that large quantities of equipment must

pressure vessel with one end open and formed into a nozzle. The addition of a suitable igniter completes this rocket.

The ramjet is another favoured power-plant for high-speed guided missiles. With this system, high thrust is obtained at high speed and with a moderate fuel-consumption rate, giving a range, under the proper conditions, greater than that of a comparable rocket. The notable disadvantage of this engine is its inability to produce thrust while not moving. As a result ramjet-powered missiles are usually powered initially by a rocket booster to give the missile sufficient forward speed for the ramjets to become effective. Hybrid jet engines will perhaps overcome this disadvantage while retaining most of the ramjet's advantages.

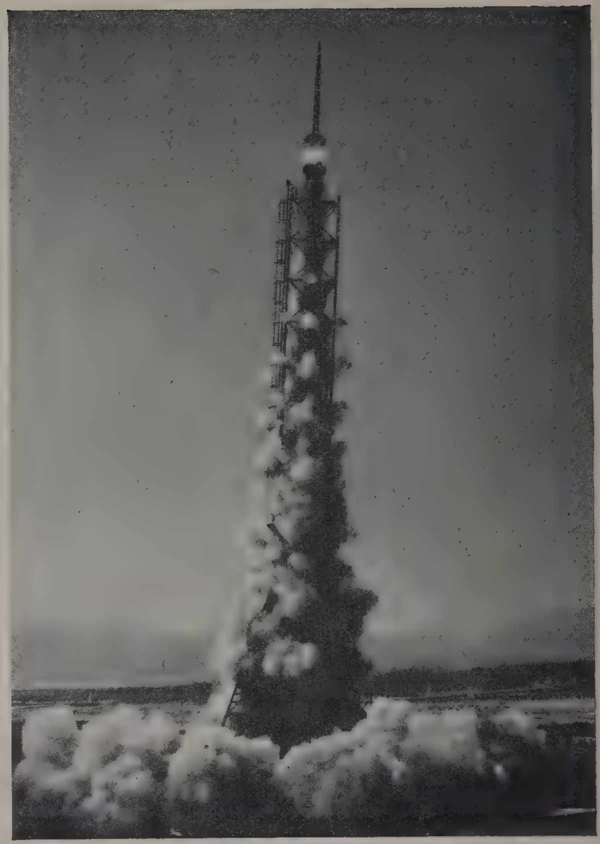
As the power required by supersonic missiles increases, the power-plant becomes a progressively larger portion of the vehicle. The airframe of a ballistic rocket is largely composed of the propulsion system and tankage. Also, the rocket booster for a ramjet vehicle can represent a large portion of that vehicle's size. Even the turbojet engine, ducting, and tankage of a subsonic missile can dominate the airframe.

The sole purpose of the guided missile, as we are now considering it, is to destroy. We must then consider the warhead as the primary item in any missile. The warhead may consist of smaller missiles launched from the mother missile, high-explosive charges or nuclear devices. The basic missile must carry this warhead to the desired place; it then remains for the warhead to perform its job of destruction, which is the end purpose of the entire missile.

To describe only the missile itself would be telling only half the story. Without supporting equipment the guided missile would be quite useless. Whether it is launched from the ground, from a

A rocket under test on the static test-stand at North American's Aerophysics Field Laboratory in the Santa Susana mountains north of Los Angeles.

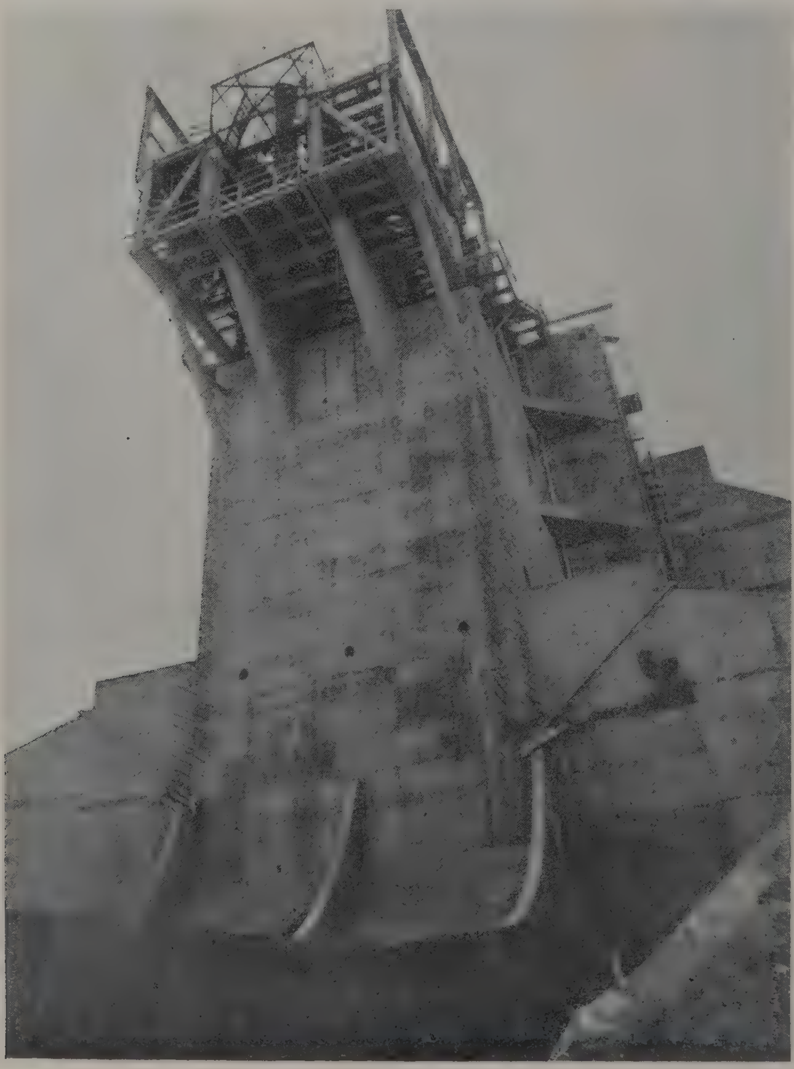
Right—An Aerobee research rocket leaving its launching tower. The Aerobee, which is used to carry aloft instruments to record the physical properties and phenomena of the upper air, has reached an altitude of 123 miles.



be involved in such a complex information exchange.

An operational guided missile does not just happen. Only general remarks can be made regarding the typical sequence of events preceding the military utilization of a guided missile. Just when a guided missile begins its evolution is difficult if not impossible to determine. We can say that it begins to develop when technical progress indicates that such a vehicle is feasible. To reach this point, basic research programmes and specific development programmes are necessary. A guided missile is not a sudden item resulting from an inspiration ; rather, it is evolved from past research and development combined with original and creative thinking. Often the most generalized type of research can supply information vital to the conception or further development of a missile. It must be acknowledged, however, that rarely is a programme initiated for a guided missile for which all technical problems are resolved, prior research and development notwithstanding. Specific missile development is initiated, based upon that which technical advances indicate can be done.

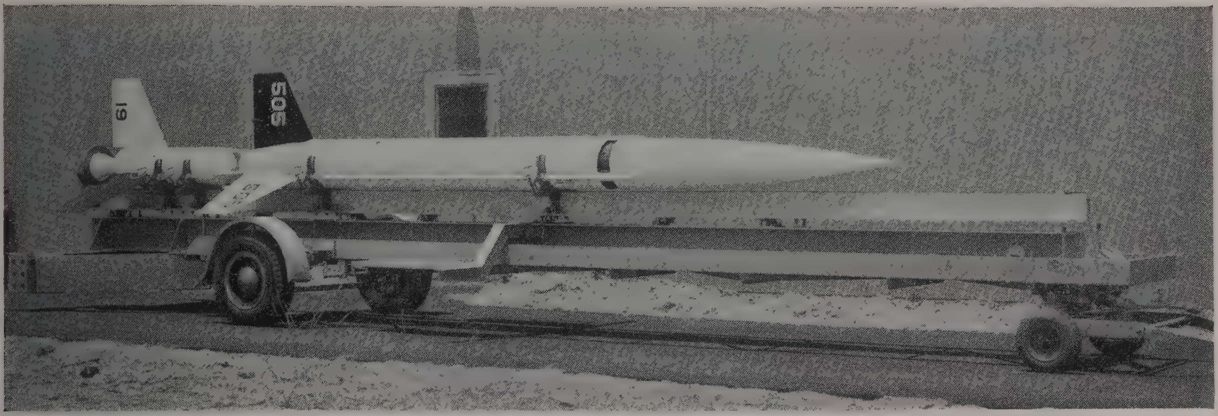
If there were no requirement for a missile it would not be developed. We find then that the "state of the art" depends upon military requirements. The requirement is needed to promote development and development is needed to further define the requirement. Usually the requirement for a mission to be performed by a guided missile is established by the military. There are exceptions, however, when, by virtue of technical advancement, an industrial concern or a laboratory recognizes the possibility for the application of a technical feature to a military mission.



Having established a requirement for a guided missile, it becomes necessary to determine what organization will develop it. The organization, upon being appraised of the requirement by the military, conducts a preliminary design and analysis to determine the probable characteristics of the missile. A proposal is then prepared, based upon the design, and submitted to the military authorities for a competitive evaluation. Frequently evaluated in addition to the technical feasibility are the estimated cost, development time, and the company's ability to perform, based upon manpower and facility availability. One or several of the competing organizations may be selected to proceed on the missile development, pending satisfactory contractual agreement.

Before a component or an assembly can be built and tested, a period of research, development,

Left—A static test stand at the Experimental Rocket Engine Test Center, Edwards Air Force Base, California. To provide the stability needed to withstand the tremendous strains put on test stands by the firings of large rocket motors, the cement and steel structures are built on slopes with footings penetrating as deep as sixty feet into solid granite.



An Aerobee research rocket on its handling trolley. The Aerobee is powered by an Aerojet-General liquid-propellant rocket and is boosted by a solid-fuel rocket of the same make.

and design is usually necessary. During this period, a more careful and detailed analysis is conducted to refine or verify the design submitted in the proposal. As progress is realized, the designs are materialized into components for testing. Any necessary re-design and improvement is then incorporated until a component is considered satisfactory for its function in the missile.

After a period of suitable research and development, prototype vehicles are constructed for testing under diverse environmental and flight conditions. This does not mean the cessation of developmental work, but a new phase of development and testing. The transition from the first prototype to the production missile is a lengthy and arduous period with multitudinous problems.

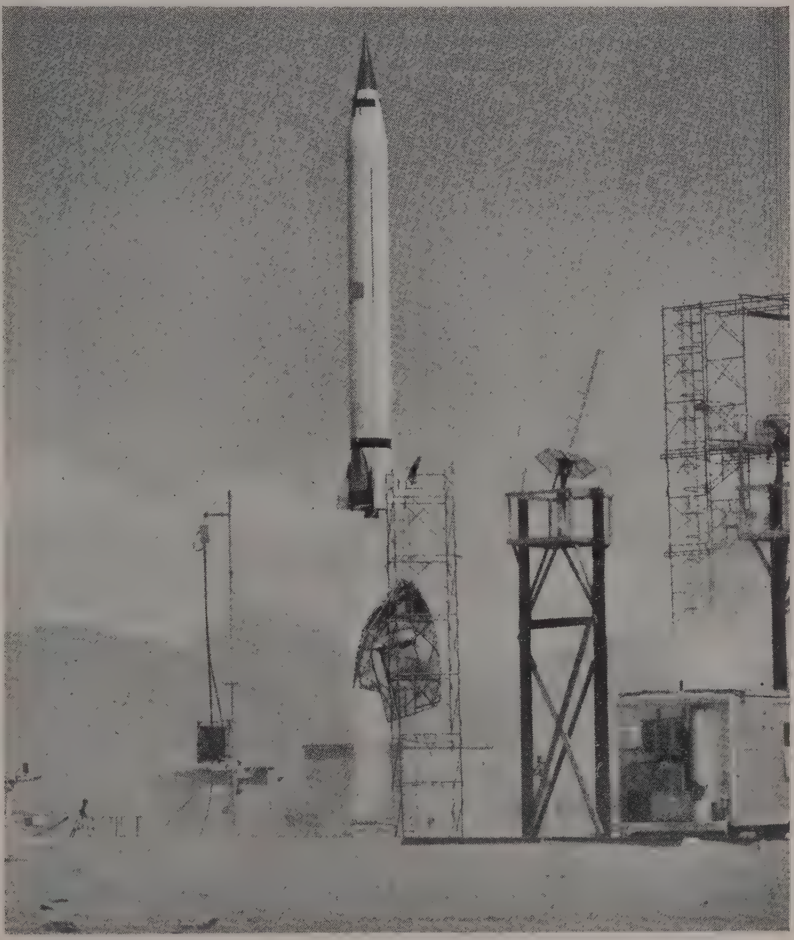
Assuming the missile completes its flight-approval tests and is accepted for production, the development aspect is still rarely completed. Almost any man-made item can be improved upon; hence we consider a phase known as "product development." This is the further improvement of the missile to do perhaps a better job, a more diverse job, or to facilitate production. From this phase may also come developments which indicate that a missile of more advanced concept is technically possible, and we may re-enter the sequential development of an operational guided missile.

Thus far we have considered guided missiles in general without specific discussion of the basic types which exist and the types of mission they perform. Beginning in the general sense, the medium from which the missile is launched and the medium in or on which the target is located serves to identify the type. At present these media are surface, air, and underwater. Eight combinations can be obtained from such a group:—

1. Surface-to-surface.
2. Air-to-surface.
3. Underwater-to-surface.
4. Surface-to-underwater.
5. Underwater-to-underwater.
6. Surface-to-air.
7. Air-to-air.
8. Air-to-underwater.

As an additional general category there are the research vehicles used purely for gathering experimental data. These can be divided into two groups, those for upper altitude research and those for direct missile research.

Because of security restrictions, adequate descriptions of the United States missile arsenal is impossible; however, some details and descriptive remarks which can be made regarding many of the vehicles are included in the table on the next page.



Martin Viking No. 11 leaving its launching stand at White Sands Proving Ground, New Mexico, on May 23, 1954. This V-2 type rocket reached an altitude of 158 miles, a record for single-stage rockets.

Many guided missiles destined for future service cannot be mentioned for security reasons. It can be stated, however, that guided missiles are in their infancy and the future promises a maturity which may be of benefit to all mankind.

The central control room at the Experimental Rocket Engine Test Center at the Edwards Air Force Base, California. The engineer in charge (in foreground) stands ready to operate the firing switch, another engineer is using a periscope to observe the flame pattern, while a third technician checks one of the critical recorders.

Category	Name	Designation	Manufacturer	Type of Propulsion	Remarks
SURFACE-TO-SURFACE	Matador	TM-61	Martin	Turbojet	For U.S.A.F. Aeroplane configuration. Uses zero-length launchers. Operational. For further details see under "Martin."
	Regulus	XSSM-N-8	Chance Vought	Turbojet	For U.S. Navy. Aeroplane configuration. Operationally similar to Matador. For further details see under "Chance Vought."
	Snark	SM-62	Northrop	Turbojet	For U.S.A.F. Similar to Matador and Regulus in configuration.
	Navaho	SM-64	North American	Ramjets Rocket-boosted to altitude	For U.S.A.F. Long-range supersonic guided missile.
	Honest John	—	Douglas	Solid-propellant rocket	For U.S. Army Ordnance. An unguided artillery rocket.
	Corporal	XSSM-A-17	Firestone	Liquid-propellant rocket	For U.S. Army Ordnance. A large guided artillery rocket. Also ordered for British Army.
	Redstone	—	Chrysler	Liquid-propellant rocket	For U.S. Army Ordnance. Tactical missile.
AIR-TO-SURFACE	Rascal	GAM-63	Bell	Liquid-propellant rocket	For U.S.A.F. An air-launched long-range rocket-powered missile.
SURFACE-TO-AIR	Nike	SAM-A-7	Douglas	Liquid-propellant rocket and solid-propellant booster	For U.S. Army Ordnance. Delta-wing supersonic missile. Operational. 13 U.S. cities already protected by Nike batteries.
	Talos	XSAM-N-6	McDonnell	—	For U.S. Navy. A shipboard-launched missile.
	Terrier	XSAM-N-7	Convair	Powered and boosted by solid-propellant rockets	For U.S. Navy. Similar to Nike.
	Bomarc	IM-99	Boeing	Ramjet	For U.S.A.F. Long-range interceptor rocket missile.
AIR-TO-AIR	Falcon	GAR-1	Hughes	Solid-propellant rocket	For U.S.A.F. Aircraft missile capable of supersonic speed. Hughes guidance system. Will arm latest U.S.A.F. fighters.
	Sparrow I	AAM-N-2	Douglas	Solid-propellant rocket	Being built in several modified forms. Sparrow I operational.
RESEARCH	Viking	—	Martin	Liquid-propellant rocket	For upper altitude research. V-2 type rocket. Viking No. 11 holds World's single-stage altitude record at 158 miles.
	Aerobee	—	Aerojet-General	Liquid-propellant rocket and solid-propellant booster	For upper altitude research. Smaller than Viking. Has reached altitude of 123 miles.
	NATIV	—	North American	Rocket	Test vehicle for aerodynamic research. Has reached trajectory altitude of 10 miles.
	Hermes	—	—	—	For direct missile research. No details available.

ALL THE
WORLD'S AEROPLANES

(CORRECTED TO JULY 31, 1955.)

SOME FIRST FLIGHTS MADE DURING THE PERIOD AUGUST 1, 1954—JULY 31, 1955

1954

August

1 NU-200 Sikumbang (Indonesia).
2 Convair XFY-1 (1st free vertical flight) (U.S.A.).
4 English Electric P.1 (G.B.).
5 Boeing B-52A (1st production) (U.S.A.).
11 Folland Midge (G.B.).
11 Aubert PA.204 (France).
18 AISA 1-18 (Spain).
23 Lockheed YC-130 Hercules (U.S.A.).

September

1 Fairchild C-123B (1st production) (U.S.A.).
1 Lockheed R7V-2 (U.S.A.).
1 Riley Twin-Navion 55 (prototype) (U.S.A.).
4 Sud-Ouest S.O.9000 Trident (1st flight with rocket power) (France).
5 Bristol Britannia (1st production) (G.B.).
10 Nord 3200 (France).
11 Handley Page Victor (2nd prototype) (G.B.).
29 McDonnell F-101A Voodoo (U.S.A.).

October

4 SIPA 300 (France).
6 Fairey F.D.2 (G.B.).
12 Cessna XT-37 (U.S.A.).
19 Learstar (1st production) (U.S.A.).
22 Convair R3Y-2 (U.S.A.).
28 North American FJ-4 Fury (U.S.A.).
28 Taylorcraft Ranch Wagon (1st prototype) (U.S.A.).

November

2 Convair XFY-1 (1st translation from vertical to horizontal flight) (U.S.A.).
11 Hurel-Dubois H.D.32 (single fin) (France).
16 Cessna CH-1 helicopter (2nd prototype) (U.S.A.).
16 Bell V.T.O. (U.S.A.).
25 Kawasaki KAL-2 (Japan).
29 Texas A. & M. College Ag-3 (U.S.A.).

December

1 Convair C-131B (U.S.A.).
5 Sud-Ouest S.O.4050-03 Vautour (3rd prototype) (France).
7 Chase XC-123D (U.S.A.).
8 Nardi FN-333 (Italy).
18 Lamson Air Tractor (1st production) (U.S.A.).
20 Convair YF-102A (U.S.A.).
28 Nord 1750 Norelfe helicopter (France).
30 Martin B-57C (U.S.A.).
31 Piasecki HUP-4 helicopter (U.S.A.).

1955

January

4 Douglas B-66B (U.S.A.).
5 LK-1 (Yugoslavia)
15 Fokker S.14 Mach Trainer (1st production) (Holland).
17 North American F-100C Super Sabre (U.S.A.).
18 Bristol Britannia (2nd production) (G.B.).
19 Nord N.C.856N (France).
29 Blackburn Beverley (1st production) (G.B.).

February

1 Fleet Courier (Canada).
11 Hurel-Dubois H.D.32 (2nd prototype) (France).
11 Nord-SFECMAS 1402 Gerfaut IB (France).
23 Commonwealth CA-25 Winjeel (1st production) (Australia).
23 Riley Twin-Navion 55 (1st production) (U.S.A.).

March

2 Dassault Super-Mystère B.1 (France).
12 Sud-Est S.E. 3130 Alouette II helicopter (France).
17 Sud-Ouest S.O.4050 Vautour (1st pre-production) (France).
26 Breguet 965 (France).

April

4 Lockheed YC-121F (U.S.A.).
7 Lockheed C-130A Hercules (1st production) (U.S.A.).
19 Boeing YC-97J (U.S.A.).
28 FFA P-16 (1st prototype) (Switzerland).

May

5 McDonnell XV-1 convertiplane (1st translation from helicopter to aircraft flight) (U.S.A.).
27 Sud-Est S.E.210 Caravelle (France).

June

11 SIPA 1000 Coccinelle (France).
15 Frati F.8 Falco (Italy).
24 Scottish Aviation Twin Pioneer (G.B.).
25 Dassault M.D.550 (France).
27 Dornier Do 27 (Continental engine) (Spain).

July

14 Martin XP6M-1 Seamaster (U.S.A.).
17 Sud-Ouest S.O.9050 Trident II (France).
18 Folland Gnat (G.B.).
18 English Electric P.1 (2nd prototype) (G.B.).
27 Republic XF-84H (U,S,A.),

THE ARGENTINE REPUBLIC

I.A.

INDUSTRIAS AERONAÚTICAS Y MECÁNICAS DEL ESTADO — INSTITUTO AEROTÉCNICO (I.A.).

CORDOBA.

Director General of I.A.M.E.: Brigadier Mayor D. Alberto Nicolás Ferro Sessarego.

Director, Instituto Aerotécnico: Commandante D. Roberto Merino.

The Instituto Aerotécnico now forms part of the Industrias Aeronaúticas y Mecánicas del Estado (I.A.M.E.) which was formed in 1952 to take over and control all State activities concerned with the design and construction of aircraft, engines, accessories, equipment and materials, both military and civil, used in the Republic.

The administration of the I.A.M.E. is undertaken by a Board of Directors presided over by the Minister of Aeronautics.

The Instituto Aerotécnico, which was absorbed into the Industrias Aeronaúticas y Mecánicas del Estado in 1952, traces its origins back to 1927 when a Fabrica Militar de Aviones was established at Cordoba. The Instituto Aerotécnico began building aircraft of its own design in 1932.

The most notable products of the Instituto Aerotécnico have been the I.A. 27 Pulqúi I, the first jet-propelled aircraft to be designed, built and flown in Latin America; and the I.A. 33 Pulqúi II, the first Latin American swept-wing jet fighter. The former flew for the first time on August 9, 1947, and the latter on June 27, 1950.

The Pulqúi II, which incorporates the latest developments in the field of high-speed aerodynamics, was designed by Prof. Dipl. Ing. Kurt Tank, former technical director of the German Focke-Wulf concern. Six Pulqúi II's have been built.

A more powerful all-weather version of the Pulqúi II is understood to be under development.

The latest product of the Instituto Aerotécnico is the I.A. 35, a description of which appears hereafter.

The earlier products of the Instituto Aerotécnico have been fully illustrated and described in previous editions of "All the World's Aircraft."

THE I.A. 41 URUBÚ.

The I.A. 41 is a single-seat development of the I.A. 34 two-seat tail-less glider, but details were lacking at the time of closing for press.

DIMENSIONS.—
Span 18.0 m. (59 ft.).
Length 5.8 m. (19 ft.).
Wing area 28.2 m.² (303 sq. ft.).

The I.A. 41 Urubú Single-seat Tail-less Glider.

The I.A. 34 Two-seat Tail-less Glider.

WEIGHTS.—
Weight empty 250 kg. (550 lb.).
Weight loaded 450 kg. (990 lb.).

THE I.A. 34 CLEN AUTÚ (SUNRAY).

The I.A. 34 all-wing glider was designed by the well-known German tail-less aircraft expert, Dr. Reimar Horten. It was the first engineless aircraft to be built by the I.A. and was first towed off the ground in June, 1949.

DIMENSIONS.—
Span 18.0 m. (59 ft.).
Length of body 3.50 m. (11 ft. 6 in.).
Overall length 4.40 m. (14 ft. 5 in.).
Height in line of flight 1.60 m. (5 ft. 3 in.).
Wing area 19.0 m.² (205 sq. ft.).
Sweepback 22°40′ at 25% of chord.

WEIGHTS AND LOADINGS (Two-seater).—
Weight empty 275 kg. (605 lb.).
Weight loaded 475 kg. (1,045 lb.).
Wing loading 25 kg./m.² (5.1 lb./sq. ft.).

PERFORMANCE.—
Gliding angle 1 : 28.5 at 75 km.h. (46.5 m.p.h.).
Landing speed 60 km.h. (37.3 m.p.h.).

THE I.A. 35.

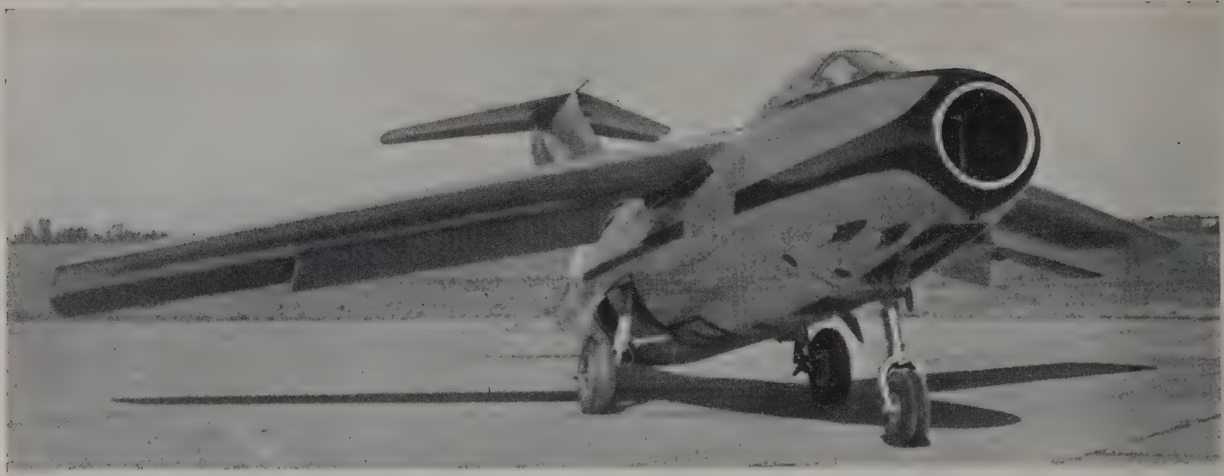
The I.A. 35 is a twin-engined aircraft which has been designed to fulfil a multiplicity of duties. It may be adapted as (*a*) a light transport carrying a crew of three and eight passengers; (*b*) an ambulance with accommodation for a crew of three, four stretcher cases and two medical attendants; (*c*) an advanced pilotage or crew trainer for a crew of three, one instructor and four pupils; (*d*) a light reconnaissance or photographic aircraft with a crew of four and special equipment; and (*e*) a light bomber with a crew of five, machine-gun armament and stowage for medium-calibre bombs.

TYPE.—Twin-engined General Purposes monoplane.

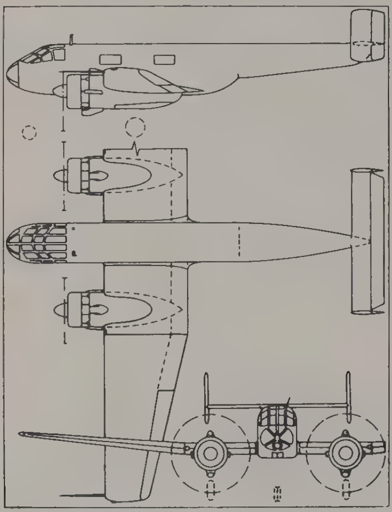
WINGS.—Low-wing cantilever monoplane. Wing in three sections of all-metal construction. Flaps inboard of ailerons. Thermal de-icing.

FUSELAGE.—All-metal structure in four sections.

The I.A. 35 General Purposes Monoplane (two 620 h.p. I.A. 3 190 II Indio engines).



The I.A. 33 Pulqúi II Single-seat Fighter (Rolls-Royce Nene engine).



The I.A. 35 General Purposes Monoplane.

Tail Unit.—Cantilever monoplane type with twin fins and rudders. All-metal construction.

Landing Gear.—Retractable nose-wheel type. Hydraulic retraction.

Power Plant.—Two 620 h.p. I.A. 3 190 I1 Indio nine-cylinder radial air-cooled supercharged engines. Rotal three-blade controllable-pitch airscrews. Fuel tanks in wings.

Accommodation.—Crew in forward section of fuselage, cabin in centre section. Accommodation varies according to function of aircraft. See introduction.

Dimensions.—
Span 19.6 m. (64 ft. 3 in.).
Length 13.98 m. (45 ft. 10 in.).

Weights.—
Weight empty 3,500 kg. (7,700 lb.).
Normal loaded weight 5,700 kg. (12,540 lb.).

Performance.
Max. speed 363 km.h. (225 m.p.h.).
Max. cruising speed 353 km.h. (219 m.p.h.).
Most economic cruising speed 346 km.h. (214.8 m.p.h.).
Landing speed 114 km.h. (70.8 m.p.h.).
Ceiling 6,500 m. (21,320 ft.).
Range 1,500 km. (930 miles).

THE I.A. 33 PULQÚI (ARROW) II.

Type.—Single-seat Jet-propelled Fighter.

Wings.—High mid-wing cantilever monoplane with 40° sweepback. All-metal stressed-skin structure. All-metal stressed-skin ailerons have hydraulic boost and leading-edge balance. Flaps inboard of ailerons. Gross wing area 25.1 m.² (268 sq. ft.).

Fuselage.—Circular section all-metal semi-monocoque structure.

Tail Unit.—Cantilever monoplane type with adjustable tailplane mounted on top of fin. Fin and rudder sweepback 50°, tailplane sweepback 45°. Metal-covered control surfaces, all statically and aerodynamically balanced and fitted with trim-tabs.

Landing Gear.—Retractable tricycle type. Air-oil shock-absorbers. Main wheels raised inwardly into fuselage, nose-wheel forward into fuselage nose. Hydraulic retraction. Steerable nose-wheel with non-shimmy shock-absorber. Brakes on all wheels.

Power Plant.—One Rolls-Royce Nene 2 centrifugal-flow turbojet engine in rear fuselage with nose air-entry and tail jet exit. Fuel tanks in fuselage (1,250 litres= 275 Imp. gallons) and wings (800 litres= 176 Imp. gallons).

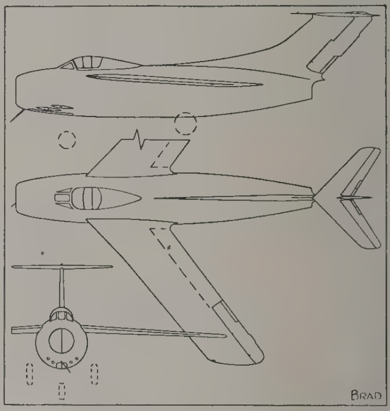
Accommodation.—Pressurised cockpit with sliding and jettisonable canopy. Pilot armour and bullet-resisting windscreen. Ejection seat. Automatic pilot.

Armament.—Four 20 mm. cannon in fuselage nose. Gyro gun-sight.

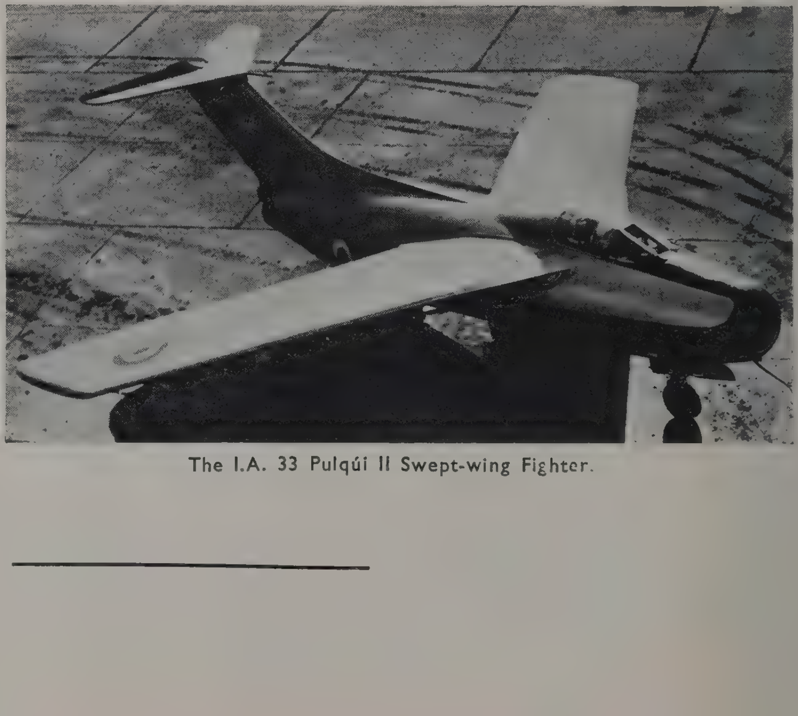
Dimensions.—
Span 10.60 m. (34 ft. 9 in.).
Length 11.60 m. (38 ft. 0 in.).
Height (over tail) 3.30 m. (10 ft. 10 in.).

Weights (Designed).—
Empty 3,600 kg. (7,920 lb.).
Military load 1,950 kg. (4,290 lb.).
Loaded 5,550 kg. (12,210 lb.).

Performance (Estimated).—
Max. speed at 5,000 m. (16,400 ft.) 1,040 km.h. (646 m.p.h.).
Rate of climb at S/L 1,790 m./min. (5,870 ft./min.).
Climb to 10,000 m. (32,800 ft.) 8.2 min.
Absolute ceiling 15,100 m. (49,530 ft.).
Landing speed (at 4,000 kg.=8,800 lb.) 177 km.h. (110 m.p.h.).



The I.A. 33 Pulqúi II.



The I.A. 33 Pulqúi II Swept-wing Fighter.

BELGIUM

AVIONS FAIREY

AVIONS FAIREY S.A.

HEAD OFFICE, WORKS AND AERODROME: GOSSELIES, NEAR CHARLEROI.

Managing Director: Mr. E. O. Tips, A.F.R.Ae.S., C.O.C.

The Belgian company was formed in 1931 as a subsidiary of the English Fairey Aviation Co., Ltd. The factory suffered considerable damage due to the bombing on May 10, 1940. Rebuilt after the liberation, the factory is now once again in working order and its activities cover the design and manufacture of aircraft and the repair and overhaul of military and civil aircraft.

Mr. E. O. Tips, designed and built in 1935, a light single-seat touring monoplane known as the Tipsy "S". This machine and the two-seat version which followed met with considerable success and licences for their construction were acquired in England, France, Spain and South Africa.

The two-seater version was revived after the war under the name of Belfair, and a new single-seater, the Tipsy Junior, was produced. The Junior is now re-designed around the 65 h.p. Continental engine and an enclosed cockpit may be fitted, but production will await a suitable market.

The company completed in 1944 a large order for Gloster Meteor Mk. 8 fighters for the Belgian Government. It has also converted a considerable number of Meteor Mk. 4 fighters into Mk. 7 trainers. A large number of modifications were embodied during the overhaul and conversion of these aircraft.

Avions Fairey has expanded and is still expanding its facilities at a high rate in order to cope with the manufacture of a substantial number of Hawker Hunter Mk. 4 and Mk. 6 fighters for N.A.T.O. and the Belgian Air Force. Parts and components for these aircraft are being airlifted from the United Kingdom direct to Gosselies aerodrome.

SABCA

SOCIÉTÉ ANONYME BELGE DE CONSTRUCTIONS AÉRONAUTIQUES.

HEAD OFFICE AND WORKS: 1,470 CHAUSÉE DE HAECHT, HAREN, BRUSSELS.

The Société Anonyme Belge de Constructions Aéronautiques was, before the late war, the largest aircraft works in Belgium and in addition to building aircraft and aero-engines under licence for the Belgian Government and the S.A.B.E.N.A.company, it also designed and built aircraft of original design.

Throughout the war the company's factory was occupied by the enemy. It was seriously damaged in Allied bombing attacks and most of its machinery and equipment were dispersed.

Repair and re-equipment of the plant have now been completed and aeronautical activities have been resumed.

Apart from undertaking the study of certain aircraft design projects, the company is engaged in the assembly, maintenance and repair of Republic F-84E fighter aircraft, and is collaborating with Avions Fairey in the production of a series of Hawker Hunter single-seat fighters for the Belgian Government.

SABCA now has special facilities for the manufacture of landing-gears, hydraulic systems and fuel systems.

BRAZIL

FOKKER

FOKKER INDUSTRIA AERONAUTICA S.A.

HEAD OFFICE: RUA DA ASSEMBLEIA 11 (SALA 503), RIO DE JANEIRO.

WORKS: GALEÃO AIRPORT, RIO DE JANEIRO.

This is a new company which has been formed with the assistance of the Brazilian Government. It is occupying the former Government factory on the Galeão Airport in return for a small annual payment. The Dutch Fokker company has a financial interest in the Brazilian company, which holds production licences for the S.11, S.12 and S.14 trainers which will be built for the Brazilian Government.

The company has received initial orders for 100 S.11 Instructors, 50 S-12's and 50 S.14 Mach-Trainer I's to be powered by Rolls-Royce Derwent engines.

The parent company will provide some tooling equipment for production and at the outset will supply component parts for assembly by the Brazilian company until such time as local production gets under way.

I.P.T.

INSTITUTO DE PESQUISAS TECHNOLOGICAS (Institute of Technical Research).

HEAD OFFICE: PRAÇA CEL. FERNANDO PRESTES, 110, CAIXA POSTAL 7141, SÃO PAULO.

Chief of the Scientific Department: Eng. Frederico Abranches Brotero.

Chief of the Aeronautical Section: Eng. Romeu Corsini.

This establishment, which is principally engaged in research, particularly with regard to the qualities of national materials suitable for use by the Brazilian Aircraft Industry, has designed and built a number of prototypes of light aircraft, sailplanes and gliders. These are mainly experimental prototypes and are not intended for commercial production. They employ materials and equipment of national origin, notably structural members, plywood and airscrews of indigenous timbers, the qualities of which are being investigated by the I.P.T.

The types I.P.T. 0 to I.P.T. 14 have been described in previous editions of "All the World's Aircraft." The latest designs are the I.P.T. 16 single-seat light cabin monoplane and the I.P.T. 17, a high-performance sailplane

THE I.P.T. 16.

TYPE.—Single-seat Light Cabin monoplane.

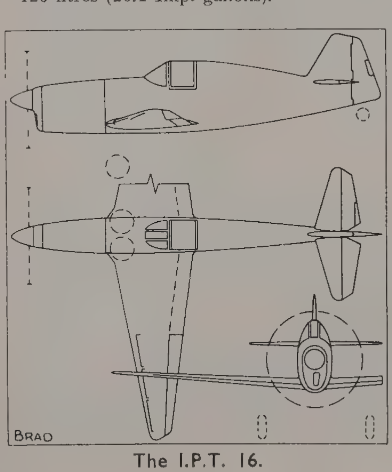
WINGS.—One-piece cantilever low-wing monoplane. Aspect ratio 7.4. Taper ratio 1 : 0.25. Two-spar wooden structure with plywood covering. Mechanically-operated split trailing-edge flaps between ailerons and fuselage Letterbox fixed slots in wings ahead of ailerons. Wing area 86.4 sq. ft. (8.0 m.²).

FUSELAGE.—Wooden monocoque structure with stressed plywood skin.

TAIL UNIT.—Cantilever monoplane type. Wooden structure with plywood covering on rudder and elevators. Controllable trim-tab in starboard elevator.

LANDING GEAR.—Retractable tail-wheel type. Each main wheel carried in half-fork on oleo-spring shock-absorber leg, retracted inwards under wing and fuselage and is contained in well projecting ahead of leading-edge. Mechanical operation. Hydraulic brakes. Non-retractable tail-wheel.

POWER PLANT.—One 160 h.p. inverted four-cylinder air-cooled engine driving a two-blade wooden airscrew. Fuel capacity 120 litres (26.4 Imp. gallons).



The I.P.T. 16.

DIMENSIONS.—
Span 7.7 m. (25 ft. 2 in.).
Length 7.0 m. (23 ft.).
Height 2.1 m. (6 ft. 11 in.).

WEIGHTS AND LOADINGS.—
Weight empty 440 kg. (970 lb.).
Disposable weight 200 kg. (440 lb.).
Weight loaded 640 kg. (1,410 lb.).
Wing loading 80.5 kg./m.² (16.5 lb./sq. ft.).
Power loading 4 kg./h.p. (8.8 lb./h.p.).

PERFORMANCE.—
Max. speed 340 km./h. (212 m.p.h.).
Cruising speed 300 km./h. (187 m.p.h.).
Stalling speed 90 km./h. (56 m.p.h.).
Endurance 3.5 hrs.
Range 1,050 km. (650 miles).

THE I.P.T. 17.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Cantilever monoplane. NACA 643-618 wing section. Aspect ratio 22. Chord 1.33 m. (4 ft. 4 in.) at root, 0.39 m. (1 ft. 4 in.) at tip. Dihedral 2° 30′. Incidence 4° 30′. All-wood monospar semi-monocoque structure with stressed plywood skin. All-wood Fowler type flaps. Differentially-controlled top-hinged all-wood ailerons. Area of flaps 2.0 m.² (21.5 sq. ft.). Area of ailerons 1.4 m.² (15 sq. ft.). Gross wing area 16.4 m.² (175 sq. ft.).

FUSELAGE.—All-wood monocoque structure with plywood skin. Width of fuselage 0.6 m. (2 ft.).

TAIL UNIT.—Cantilever monoplane type. Wood structure with plywood-covered fixed surfaces and fabric-covered elevators and rudder. Controllable trim-tab in starboard elevator. Areas: fin 0.186 m.² (2 sq. ft.), rudder 0.9 m.² (9.6 sq. ft.), tailplane 1.31 m.² (12.2 sq. ft.), elevators 0.79 m.² (8.5 sq. ft.). Tailplane span 3.2 m. (10 ft. 6 in.).

LANDING GEAR.—Permanent central skid. Auxiliary detachable gear for take-off.

ACCOMMODATION.—Enclosed cockpit for pilot

with moulded Plexiglas canopy conforming to lines of fuselage.
DIMENSIONS.—
Span 19 m. (62 ft. 6 in.).
Length 7.70 m. (25 ft.).
Height overall 1.44 m. (4 ft. 8 in.).
WEIGHTS (Designed).—
Weight empty 270 kg. (600 lb.).
Useful load 90 kg. (200 lb.).
Weight loaded 360 kg. (800 lb.).
PERFORMANCE (Estimated).—
Best gliding ratio 1 : 38 at 76 km.h. (47 m.p.h.).
Min. sinking speed 0.53 m./sec. (1 ft. 9 in./sec.) at 61 km.h. (38 m.p.h.).

MUNIZ

CASSIO MUNIZ S.A.

HEAD OFFICE AND WORKS: PRAÇA DA REPUBLICA, 309, SÃO PAULO.

Cassio Muniz S.A. are primarily importers and distributors of several types of American light aircraft and engines. The company has, over a period of years, sold more than 600 Cessna aircraft alone in Brazil.

Because of the rigorous government control of the importation of aircraft, Cassio Muniz have designed and built in prototype form the Casmuniz 52 twin engined five-seat cabin monoplane, the first all-metal twin-engined aircraft to be built in Brazil.

This aircraft has been designed specially to operate from landing fields of limited size and to be used where maintenance and repair facilities are scarce. Consequently, 80 per cent of the skin is made of unformed or single-curvature aluminium sheet panels to facilitate replacement in any locality of limited resources.

The prototype Casmuniz 52 was, at the time of writing, undergoing flight tests to obtain an approved type certificate in accordance with Regulation CAR-03 of the U.S. Civil Aeronautics Administration.

This testing is being conducted by the Oficina de Manutenção e Recuperação de Aviões, Ltda. (OMAREAL) of Botucatu, State of São Paulo, which concern will also be responsible for the series production of the Casmuniz 52.

The Casmuniz 52 Light Transport (two 185 h.p. Continental E185 engines).

THE CASMUNIZ 52.

TYPE.—Twin-engined Five-seat Cabin monoplane.
WINGS.—Low-wing cantilever monoplane. All-metal structure. Electrically-operated split flaps.
FUSELAGE.—All-metal structure.
TAIL UNIT.—Cantilever monoplane type. All-metal structure. All controls (including aileron controls) are by duralumin tubes supported at joints and articulations by roller bearings. All trim tabs are positioned electrically by toggle switches on pilot's panel.
LANDING GEAR.—Retractable tail-wheel type. Electric actuation with emergency hand-operated control. Steerable tail-wheel.
POWER PLANT.—Two 185 h.p. Continental E185 six-cylinder horizontally-opposed air-cooled engines. Hartzell two-blade controllable two-position metal airscrews. Production aircraft will have constant speed feathering airscrews.
ACCOMMODATION.—Cabin seats pilot and four passengers, with pilot and one passenger in front and three passengers on cross bench at rear of cabin. Future aircraft will seat six persons in three pairs. Large entrance door on starboard side. Controlled ventilation. Baggage compartment behind cabin with outside access door.
EQUIPMENT.—12-volt electrical system. Landing lights, navigation lights and complete instrumentation for blind flying. G.E. radio transreceiver.
DIMENSIONS AND WEIGHTS.—
No data supplied.
PERFORMANCE (Provisional).—
Max. speed 320 km.h. (200 m.p.h.).
Cruising speed over 264 km.h. (over 165 m.p.h.).
Stalling speed 80 km.h. (50 m.p.h.).
Range 1,120 km. (700 miles).
Take-off run (full load) 275 m. (300 yds.).

NEIVA

SOCIEDADE CONSTRUTORA AERONAUTICA NEIVA, LTDA.

HEAD OFFICE AND WORKS: AERODROMO DE MANGUINHOS, RIO DE JANEIRO.
Director: J. C. Barros Neiva.

This concern is supplying Neiva B-2 Monitor two-seat sailplanes for use in the Brazilian Government's gliding clubs programme. The B-2 holds the South American duration record for two-seat sailplanes with a flight of 11 hours 37 minutes.

The BN-1 is the company's latest product. It is in production for the Brazilian Government for distribution to the National gliding clubs. In the second National Soaring Competition the BN-1 took first place and also put up three new Brazilian records, including a goal flight of 332 km. (206 miles).


Two views of the Neiva BN-1 Sailplane.

THE NEIVA BN-1.

TYPE.—Single-seat High-performance Sailplane.
WINGS.—Cantilever high-wing monoplane. Wing section NACA 4415 at root, NACA 4412 at mid-span and NACA 2R1 12 at tip. Aspect ratio 19. Chord at root 1.28 m. (4 ft. 2 in.), at tip 0.42 m. (1 ft. 4½ in.). Dihedral 2°. Incidence 4° at root. Single I-spar structure with plywood-covered torsion-resistant leading-edge and upper surface. Fabric covering on under surface. Wood-framed fabric-covered ailerons with differential control. Wood spoiler flaps. Area of ailerons (2) 2.0 m.² (21.5 sq. ft.). Gross wing area 13.47 m.² (144.9 sq. ft.).
FUSELAGE.—All-wood semi-monocoque structure. Frontal area 0.42 m.² (4.52 sq. ft.).
TAIL UNIT.—Cantilever monoplane type. Wood frames with plywood and fabric covering. Areas: fin 0.35 m.² (3.7 sq. ft.), rudder 0.65 m.² (7.0 sq. ft.), tailplane and elevator 1.60 m.² (17.2 sq. ft.). Tailplane span 3 m. (9 ft. 11 in.).
LANDING GEAR.—Front skid and retractable single Goodyear wheel aft of C.G.
ACCOMMODATION. — Enclosed cockpit. Moulded Plexiglas canopy.
DIMENSIONS.—
Span 16.0 m. (52 ft. 6 in.).
Length 6.90 m. (22 ft. 7½ in.).
Height 1.02 m. (3 ft. 4 in.).
WEIGHTS.—Weight empty 170 kg. (374 lb.).
Disposable load 80 kg. (176 lb.).
Weight loaded 250 kg. (550 lb.).
Wing loading 18.5 kg./m.² (3.79 lb./sq. ft.).
PERFORMANCE.—
Stalling speed 50 km.h. (31 m.p.h.).
Min. sinking speed 0.54 m./sec. (1.7 ft./sec.) at 60 km.h. (37.3 m.p.h.).
Best gliding ratio 1 : 31 at 76 km.h. (47 m.p.h.).
Sinking speed at 100 km.h. (62 m.p.h.) 1.3 m./sec. (4.2 ft./sec.).
Max. safe speed 225 km.h. (140 m.p.h.).

THE NEIVA B-2 MONITOR.

TYPE.—Two-seat medium-performance Sailplane.
WINGS.—Braced high-wing monoplane. Wing section Goettingen 535. Aspect ratio 13.67. Mean chord 1.343 m. (4 ft. 4⅞ in.). Dihedral 0° 30′. Incidence (at root) 3°. Single box-spar with plywood-covered torsion-resistant leading-edge. Fabric-covering aft of spar. Normal type wood-framed fabric-covered ailerons. Wood spoiler type flaps. Areas: spoiler flaps 0.315 m.² (3.38 sq. ft.), ailerons (2) 3.124 m.² (33.61 sq. ft.). Gross wing area 18.40 m.² (198 sq. ft.).
FUSELAGE.—Semi-monocoque all-wood structure with steel-tube frames to support wing attachments.
TAIL UNIT.—Semi-cantilever monoplane type.

Wood framework with fabric covering. Areas: fin 0.30 m.^{2} (3.23 sq. ft.), rudder 1.32 m.^{2} (14.20 sq. ft.), tailplane 1.30 m.^{2} (13.98 sq. ft.), elevators 3.00 m.^{2} (32.28 sq. ft.). Tail span 3.32 m. (10 ft. 11½ in.).

LANDING GEAR.—Front skid and single Goodyear wheel aft of C.G.

ACCOMMODATION.—Cockpit seats two in tandem. Luggage compartment between pilots. Can be flown solo from front seat only.

DIMENSIONS.—
Span 15.86 m. (52 ft.).
Length 7.10 m. (23 ft. 3½ in.).
Height 1.13 m. (3 ft. 9 in.).

WEIGHTS AND LOADINGS.—
Weight empty 210 kg. (462 lb.).
Disposable load 150 kg. (330 lb.).
Weight loaded 360 kg. (792 lb.).
Wing loading 19.5 kg./m.^{2} (3.99 lb./sq. ft.).

PERFORMANCE.—
Stalling speed 52 km.h. (32.3 m.p.h.).
Best gliding speed 67 km.h. (41.6 m.p.h.).
Max. safe speed 145 km.h. (90 m.p.h.).
Best gliding ratio 1 : 21.

The Neiva B-2 Monitor Two-seat Sailplane.

THE BRITISH COMMONWEALTH
GREAT BRITAIN

AIRSPEED

The Airspeed Ambassador Airliner (two 2,600 h.p. Bristol Centaurus 661 engines).

AIRSPEED DIVISION OF THE DE HAVILLAND AIRCRAFT CO., LTD.

HEAD OFFICE: HATFIELD, HERTS.

WORKS: CHRISTCHURCH AND PORTSMOUTH, HANTS.

Directors: see The de Havilland Aircraft Co., Ltd.

General Manager, Christchurch Works: Hereward de Havilland, D.S.O.

General Manager, Portsmouth Works: J. Liddell.

Airspeed, Ltd. was responsible for the design and production of the Ambassador, twenty of which are in service with British European Airways under the class name "Elizabethan." Two Ambassadors are flying as turboprop engine test-beds, one with two Bristol Proteus and the other with two Napier Eland engines.

In 1951 Airspeed, Ltd. was merged with the de Havilland Aircraft Co., Ltd. and now operates as the Airspeed Division of the parent company.

The Airspeed Division has been responsible for the design, development and production of the D.H. 115 Vampire Trainer (described under "de Havilland"). It has also assumed similar responsibilities for the D.H. 110.

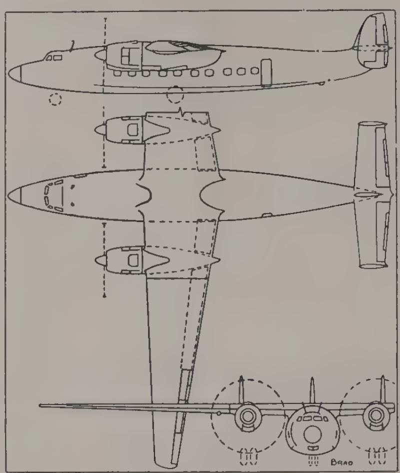
THE AIRSPEED A.S.57 AMBASSADOR.

TYPE.—Twin-engined Medium-range Airliner.

WINGS.—Cantilever high-wing monoplane. Laminar-flow aerofoil; reflexed NACA 652415 section. Aspect ratio 11. Dihedral (under surface) 1° 22′. Two-spar structure with heavy-gauge metal skin. Thermal de-icing system. Metal-framed aerodynamically balanced ailerons, with shrouded leading-edges and fabric covering. All-metal split trailing-edge flaps. Hydraulic operation. Total aileron area: 74 sq. ft. (6.86 m.²). Total flap area: 164 sq. ft. (30.4 m.²). Gross wing area: 1,200 sq. ft. (111 m.²).

FUSELAGE.—All-metal structure with cross section of two intersecting circles. Maximum external width 11 ft. 5 in. (3.48 m.).

TAIL UNIT.—Cantilever structure with twin fins and rudders at extremities of tailplane, and third fin over fuselage centre-line. All-metal structure with metal skin over fins, tailplane and rudders, and fabric-covered elevators. Outer rudders have horn-balanced portions at top and bottom, which contain mass-balances. All fins detachable and outer fins interchangeable. Pre-loaded spring tabs on outer rudders; differentially geared tabs on elevator. Tailplane span, 30 ft. 6 in. (9.3 m.).



The Airspeed A.S.57 Ambassador.

LANDING GEAR.—Retractable tricycle type of mainly Airspeed design. Twin main wheels on common axle on single shock-absorber strut retract forward into engine nacelle. Steerable nose unit comprises twin wheels on single leg which retracts forward into fuselage. Complete gear raised by hydraulic (power-pack and accumulator) operation and lowered by gravity and air-drag forces. Each main wheel has a Dunlop disc-type brake operated hydraulically from main system. Emergency bumper wheel and oleo leg in rear fuselage. Track 27 ft. 6 in. (8.4 m.); wheelbase 24 ft. 6 in. (7.4 m.).

POWER PLANT.—Two Bristol Centaurus 661 eighteen-cylinder two-row sleeve-valve radial air-cooled engines enclosed in Airspeed low-drag cowlings and mounted as interchangeable power-eggs. Each engine rated at 2,600 h.p. for take-off, 2,320 h.p. at 5,000 ft. (1,525 m.) METO power, and 1,750 h.p. at 13,300 ft. (4,050 m.) max. weak mixture cruising power. D.H. four-blade full-feathering reversible-pitch airscrews 16 ft. (4.88 m.) diameter. Integral fuel tanks in outer wings, each with capacity of 500 Imp. gallons (2,273 litres). Provision for two additional bag tanks of 300 Imp. gallons (1,364 litres) capacity each. Oil capacity 28 Imp. gallons (127 litres) per engine.

ACCOMMODATION.—Pressurised accommodation. Crew compartment forward with pilot and co-pilot side-by-side with dual controls. Wireless operator immediately behind pilot. Crew entry door forward on starboard side. Main cabin 32 ft. 5 in. long × 10 ft. 6 in. wide × 6 ft. 4½ in. high (9.9 m. × 3.2 m. × 1.9 m.) has volume of 2,168 cub. ft. (61.4 m.³). Cabin may seat up to forty-seven passengers. Main entry door on port side aft of cabin 3 ft. 6 in. (1.07 m.) from ground, with built-in stowable staircase. Two toilet compartments each of 94 cub. ft. (2.6 m.³) capacity, and cloak-room of 30 cub. ft. (0.85 m.³) capacity at rear. Baggage and freight compartments in nose (15 cub. ft. = 0.42 m.³) and aft (145 cub. ft. = 4.1 m.³). Hand luggage compartment (173 cub. ft. = 4.9 m.³) on port side between crew quarters and main cabin, and galley (220 cub. ft. = 6.22 m.³) on starboard.

DIMENSIONS.—
- Span 115 ft. 0 in. (35 m.).
- Length 82 ft. (25.0 m.).
- Height (on ground over rudders) 18 ft. 3 in. (5.55 m.).

WEIGHTS AND LOADINGS (Forty-seat version)
- Operator's empty weight 35,781 lb. (16,230 km.).
- Weight loaded 52,500 lb. (23,814 kg.).
- Max. payload 11,645 lb. (5,280 kg.).
- Wing loading 43.3 lb./sq. ft. (211.5 kg./m.²).
- Power loading 10 lb./b.h.p. (4.47 kg./b.h.p.).

PERFORMANCE.—
- Recommended fast cruising speed (65% METO power) 272 m.p.h. (438 km.h.).
- Most economical speed (45% METO power) 248 m.p.h. (400 km.h.).
- Initial rate of climb (normal) 1,225 ft./min. (6.23 m./sec.).
- Initial rate of climb (single engine) 410 ft./min. (2.08 m./sec.).
- Stage distance with full tanks and 8,000 lb. (3,630 kg.) payload at 40% METO power at 10,000 ft. (3,050 m.) 1,200 miles (1,930 km.).
- Runway length for I.C.A.O. compliance at max. all-up weight 1,530 yds. (1,400 m.).

ARMSTRONG WHITWORTH

The Armstrong Whitworth Meteor N.F.Mk.11 two-seat Night Fighter (two Rolls-Royce Derwent turbojet engines).

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT, LTD.

Head Office: Baginton, near Coventry.

Works: Baginton and Whitley near Coventry, and Bitteswell, Lutterworth, near Rugby.

Directors: Sir Frank Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman); Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S.; H. M. Woodhams, C.B.E., F.R.Ae.S. (Managing Director); Henry R. Watson, B.Sc., A.F.R.Ae.S. (Technical Director); John Lloyd, F.R.Ae.S.; W. S. D. Lockwood, O.B.E., A.M.I.P.E., A.F.R.Ae.S. (Works Director and General Manager); C. S. Emery (Sales Director).

Chief Designer: Edward D. Keen, F.R.Ae.S.

Secretary: F. D. Stallabrass.

Sir W. G. Armstrong Whitworth Aircraft, Ltd., was formed in 1921. In 1935, the Hawker-Siddeley Group was formed to amalgamate the interests of Hawker Aircraft Ltd., and the Armstrong Siddeley Development Co., Ltd., which latter company controlled Sir W. G. Armstrong Whitworth Aircraft, Ltd., Armstrong Siddeley Motors, Ltd., and A. V. Roe & Co., Ltd.

The policy of the Company has, in the main, been based upon the development of the large type of aircraft, orthodox and unorthodox, for both civil and military purposes. The unorthodox have included the A.W.52 jet-propelled flying-wing and A.W.52G flying-wing glider.

Another notable post-war product was the A.W.55 Apollo, a civil airliner powered by four Armstrong Siddeley Mamba turboprop engines. The Apollo, which received its Certificate of Airworthiness in 1950, has been fully illustrated and described in previous editions of "All the World's Aircraft."

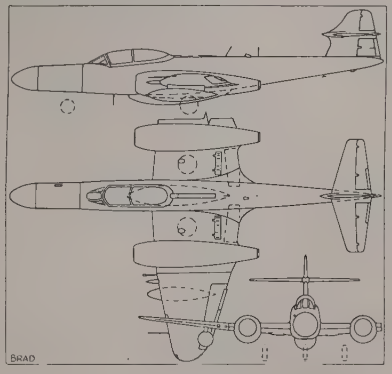
Armstrong Whitworth is in production with the Meteor two-seat night fighter, the development of which has been handled entirely by the company.

Since mid-1953 Armstrong Whitworth has also been solely responsible for the development, design and production of the Hawker Sea Hawk for the Royal Navy.

THE ARMSTRONG WHITWORTH METEOR NIGHT FIGHTER

In 1949, Sir W. G. Armstrong Whitworth Aircraft, Ltd. was entrusted with the development of a two-seat night fighter version of the Gloster Meteor. All the necessary design work was done by Armstrong Whitworth, who also undertook the construction of two prototypes, designated Meteor N.F. Mk. 11. The first of these made its first flight on May 31, 1950.

The adaptation of the Meteor airframe to meet a night fighter specification resulted in the production of a completely new aeroplane, although still retaining several of the external characteristics of the Gloster Meteor.



The Armstrong Whitworth Meteor N.F. Mk. 14.

The N.F. Mk. 11 was adopted as a standard night fighter and large numbers have been delivered to the Royal Air Force. In addition, it has also been supplied to several European air forces, including those of Belgium, Denmark and France.

Four developed versions of the Meteor night fighter have since been produced and these are enumerated below.

Meteor N.F. Mk. 11. First production version. Extended nose housing A.I. radar, Mk. 7 type side-hingeing cockpit hood, Mk. 3 type long-span outer wings, Mk. 8 type tail unit. Armament consists of four 20 mm. cannon in pairs in wings, one pair outboard of each engine nacelle.

Meteor N.F. Mk. 12. Fitted with improved radar in longer nose. Leading-edge of fin altered in shape to provide increased vertical area aft. Dimensions as for Mk. 11 except length 49 ft. 11 in. (15.2 m.). First Mk. 12 flew on April 21, 1953.

Meteor N.F. Mk. 13. Tropical version of Mk. 11 in service in Middle East. Overall dimensions as for Mk. 11. First Mk. 13 flew on December 23, 1952.

Meteor N.F. Mk. 14. Improved Mk. 12 with revised windscreen and new two-piece clear-view sliding hood in place of earlier hinged canopy. First Mk. 14 flew on October 23, 1953.

The description below refers to the N.F. Mk. 14.

Type.—Two-seat Night Fighter.

Wings.—Low-wing cantilever monoplane. Aerofoil section EC 1240 from centre-section root to wing joint, EC 1240 tapering to EC 0940 from root to tip of outer wings. Incidence 1°. Dihedral, centre-section spar datum 0° 52.5′, outer wing spar datum 6°. All-metal two-spar stressed-skin structure. All-metal ailerons with geared and spring balance tabs. Hydraulically-operated split flaps and upper and lower perforated air-brakes, latter on centre-section inboard of

The Armstrong Whitworth Meteor N.F. Mk. 14 Two-seat Night Fighter (two Rolls-Royce Derwent turbojet engines).

The Meteor Mk. 8 modified by Armstrong Whitworth with an extra cockpit for a pilot in a semi-prone position.

engine nacelles. Total area of ailerons (aft of hinge line) 14.22 sq. ft. (1.32 m.^{2}). Total area of geared tabs (aft of hinge-line) 1.24 sq. ft. (0.155 m.^{2}). Total area of spring tabs (aft of hinge-line) 1.48 sq. ft. (0.137 m.^{2}). Total area of flaps 22.9 sq. ft. (2.12 m.^{2}). Total area of air brakes 13.64 sq. ft. (1.26 m.^{2}). Gross wing area 374 sq. ft. (34.74 m.^{2}).

Fuselage.—All-metal stressed-skin structure.

Tail Unit.—All-metal stressed-skin structure. Areas: tailplane 45.36 sq. ft. (4.21 m.^{2}), elevators (aft of hinge line) 14.64 sq. ft. (1.36 m.^{2}), elevator trim tabs 1.75 sq. ft. (0.162 m.^{2}), fin (above C/L of fuselage) 30.89 sq. ft. (2.87 m.^{2}), rudder (aft of hinge-line) 8.0 sq. ft. (0.74 m.^{2}), rudder trim-tab 0.98 sq. ft. (0.091 m.^{2}). Tailplane span 15 ft. (4.57 m.).

Landing Gear.—Retractable nose-wheel type. Hydraulic retraction. Wheelbase 15 ft. 10 in. (4.83 m.). Track 10 ft. 5 in. (3.18 m.).

Power Plant.—Two Rolls-Royce Derwent 8 (3,500 lb. = 1,588 kg. s.t. each) turbojet engines. Main fuel tanks in fuselage. Provision for one auxiliary tank under fuselage and two auxiliary drop tanks under outer wings.

Accommodation.—Pressurised cockpit with tandem seats beneath two-piece clear-view sliding canopy. Martin-Baker ejector seats.

Armament.—Four 20 mm. cannon in pairs outboard of engine nacelles. No other details of equipment available.

Dimensions.—
Span 43 ft. (13.1 m.).
Length 49 ft. 11½ in. (15.2 m.).
Height 13 ft. 11 in. (4.2 m.).

Weights and Performance.—
No data available.

THE PRONE PILOT METEOR 8.

Armstrong Whitworth have modified a Gloster Meteor Mk. 8 to incorporate in an extended nose, forward of the normal pilot's cockpit, an extra cockpit to accommodate a pilot in a semi-prone position. This extra cockpit is equipped so that the pilot can perform all the normal functions of take-off, flight and landing.

All controls are interconnected to those in the normal seated cockpit so that, in an emergency, the seated pilot may take full control of the aircraft. The prone cockpit is fitted with a normal type of windscreen and canopy, together with a downward vision panel.

This research aircraft is being used for a general assessment of the semi-prone pilot's position in high-speed aircraft.

THE SEA HAWK.

The Sea Hawk was designed and the initial production was undertaken by Hawker Aircraft Ltd. The development and production of this aircraft has been the responsibility of Sir W. G. Armstrong Whitworth Aircraft Ltd. since mid-1953.

Four versions of the Sea Hawk have been announced. They are:—

Sea Hawk F. Mk. 1. Rolls-Royce Nene turbojet engine. First production version. Spring-tab ailerons. In service with the Royal Navy.

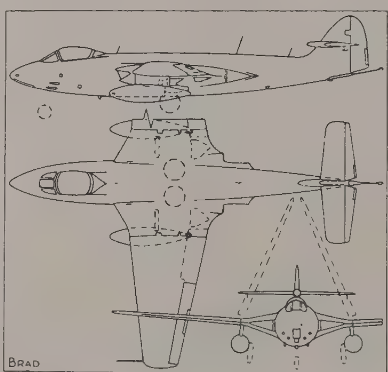
Sea Hawk F. Mk. 2. Similar to Mk. 1 but with powered ailerons.

Sea Hawk F.B. Mk. 3. Fighter-bomber version of F. Mk. 2. Wings stressed for under-wing stores such as rockets, bombs, etc.

Sea Hawk F. (G.A.) Mk. 4. The Mk. 3 adapted for a change of rôle.

Type.—Single-seat Naval Fighter.

Wings.—Cantilever mid-wing monoplane. All-metal structure with stressed heavy-gauge skin. Outer wings attached to stub wings by two hinge fittings with automatic locks and a spigot bearing in the leading-edge, and are power-folded. All-metal power-operated ailerons with spring tabs. Combined hydraulically-operated landing and brake flaps of double split type inboard of ailerons. Gross wing area 278 sq. ft. (25.8 m.^{2}). Flap area 50 sq. ft. (4.5 m.^{2}). Aspect ratio 5.5. Dihedral root to tip 4½ degrees. Incidence + ½ degrees.



The Hawker Sea Hawk F. Mk. 2.

Fuselage.—All-metal structure. Nose and centre portions are of semi-monocoque construction reinforced by a box-section keel member and four longerons; the rear portion is a pure monocoque of which the fin base is an integral part. Fuselage is stressed for tail-down accelerated take-offs; single take-off point beneath fuselage.

Tail Unit.—All-metal cantilever structure. Tailplane, of one-piece multi-spar construction, passes through fin above fuselage. Controllable trim-tabs in elevators. Total horizontal area 38.6 sq. ft. (3.59 m.^{2}). Total vertical area 33.1 sq. ft. (3.04 m.^{2}).

Landing Gear.—Retractable tricycle type. Hydraulic retraction. Dowty liquid-spring shock-absorber struts to all wheels. Sting-type arrester hook in rear fuselage. Track 8 ft. 6 in. (2.6 m.).

Power Plant.—One 5,000 lb. (2,270 kg.) s.t. Rolls-Royce Nene 103 turbojet engine in centre fuselage. Air intakes in wing leading-edge roots, exits on wing trailing-edge roots, each side of fuselage. Boundary layer bleed at junction with fuselage side. Spring-loaded doors in top surface of centre fuselage provide additional air intakes when the engine is ground running and for take-off. As pressure in the plenum chamber increases, these doors close automatically. Fuel tanks in fuselage, with provision for under-wing drop tanks.

Accommodation.—Pilot in pressurised cockpit well forward in nose of fuselage, with three-piece windscreen, including an optically-flat bullet-proof centre section, and single-piece jettisonable canopy. Martin-Baker ejector seat for pilot. Canopy can be jettisoned in conjunction with seat or by itself.

Armament. Four 20 mm. cannon mounted in lower portion of fuselage nose. Provision for bombs or rocket projectiles on under-wing racks in F.B. Mk. 3 and F. (G.A.) Mk. 4.

Dimensions.—
Span 39 ft. (11.9 m.).
Width folded 13 ft. 4 in. (4.04 m.).
Length 39 ft. 7 in. (12.1 m.).
Height 8 ft. 8 in. (2.65 m.).
Height (wing folded) 16 ft. 10 in. (5.1 m).

Weights and Performance.—
No data available.


The Sea Hawk F. Mk. I Single-seat Naval Fighter (Rolls Royce Nene turbojet engine).

AUSTER

AUSTER AIRCRAFT, LTD.

Head Office and Works: Rearsby Aerodrome, Rearsby, Leicester.

Directors: F. Bates (Managing Director), P. Wykes (Chairman), A. J. Pickering, K. Sharp, F. A. Pratley, F.C.A.

Chief Designer: R. E. Bird.

Auster Aircraft, Ltd. was formed in 1939 to manufacture light aircraft and assumed its present title on March 7, 1946. Throughout the last war many military A.O.P. aircraft were built, providing the company with considerable experience in the design of light aircraft to be operated by the Army.

Auster's latest A.O.P. aircraft, the Mk. 9 is now in quantity production. The first Mk. 9 made its first flight on March 19, 1954, and deliveries to the services began on February 11, 1955.

The Auster Ambulance/Freighter, a unique type of light freighter with both civil and military applications has been the subject of an extensive development programme.

Auster aircraft in current production include the Mk. 9 A.O.P. and various versions of the Autocar and Aiglet Trainer types.

All three- or four-seat civil Austers can be fitted with equipment for crop-dusting and spraying, cable-laying, glider-towing, banner-towing, aerial advertising, air-to-ground broadcasting, aerial photography and air ambulance duties. Skis and cross-wind landing wheels are also approved for fitment to all Austers, and those types with engines of 130 h.p. or more can be fitted with floats. All three-seaters can have a double rear seat fitted to convert them into occasional four-seaters.

The Auster A.O.P. Mk. 6 (145 h.p. D.H. Gipsy Major engine).

THE AUSTER Mks. 6 and 7.

Since the war versions of the Auster Observation Post monoplanes have continued in production for Army Co-operation use. The current versions are as follow:—

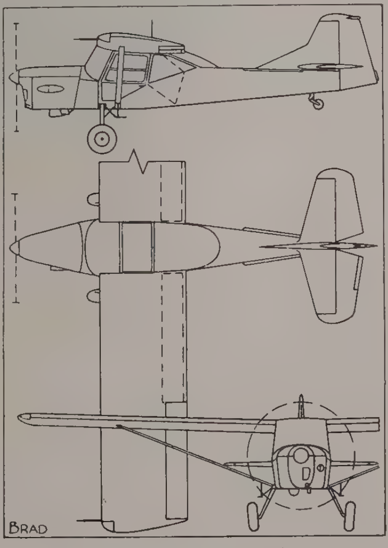
Auster A.O.P. Mk. 6. 145 h.p. D.H. Gipsy Major 7 engine. Developed from the Mk. 5. Modified fuselage and increased all-up weight. All-metal auxiliary aerofoil flaps below and behind trailing-edge, and wings have been strengthened to take two 11.5 Imp. gallon (52.25 litre) fuel tanks, giving a total capacity of 23 Imp. gallons (104.5 litres). Pilot and observer seated in tandem, the latter in a swivel chair. Radio receiver/transmitter is beside pilot's seat. Lengthened landing-gear struts to allow for larger airscrew. Initial production completed in 1949 but further production was undertaken in 1952.

Auster T. Mk. 7. Two-seat trainer quickly convertible (15 minutes) to full A.O.P. standard. Similar in construction, dimensions and external appearance to Mk. 6. Side-by-side seating with full dual control. Floor of rear of cabin strengthened to permit installation of third seat if required, and ample space is available in rear cabin for fitting of F-24 camera, cable-laying equipment, etc. Two-stage screening provided for simulated instrument and night-flying training.

Dimensions (A.O.P. Mk. 6 and T. Mk. 7).—
- Span 36 ft. 0 in. (11.0 m.).
- Length 23 ft. 9 in. (7.23 m.).
- Height 8 ft. 4½ in. (2.55 m.).
- Wing area (excluding flaps) 184 sq. ft. (17.1 m.²).

Weights and Loadings (Mk. 7).—
- Tare weight 1,469 lb. (666.2 kg.).
- Removable equipment 50 lb. (22.7 kg.).
- Crew and parachutes 400 lb. (181.3 kg.).
- Inter-comm. amplifier 10 lb. (4.5 kg.).
- Fuel and oil 193 lb. (87.5 kg.).
- All-up weight 2,122 lb. (962 kg.).

Performance (Mk. 7).—
- Max. speed 122 m.p.h. (195.2 km.h.).
- Cruising speed 107 m.p.h. (171.2 km.h.).
- Stalling speed (with flaps) 34 m.p.h. (54.4 km.h.).
- Landing speed 38 m.p.h. (60.8 km.h.).
- Initial rate of climb 660 ft./min. (201 m./min.).
- Service ceiling 12,000 ft. (3,660 m.).
- Range (still air) 315 miles (504 km.).
- Take-off run (5 m.p.h. = 8 km.h. wind) 125 yds. (114 m.).
- Landing run 90 yds. (82 m.).



The Auster A.O.P. Mk. 9.

THE AUSTER A.O.P. Mk. 9.

Type.—Three-seat Air Observation Post and Light Communications monoplane.

Wings.—High-wing braced monoplane. NACA 23012 wing section. Chord 5 ft. 6 in. (1.67 m.). Dihedral 2°. Structure comprises one built-up metal I-type main spar, pressed metal nose ribs, tubular leading-edge and pre-formed sheet metal D-section skin to form torsion box; and, aft of spar, pressed light alloy ribs covered with fabric. Moulded Durestos wing-tips. Each wing braced to fuselage by single extruded light alloy strut. Metal-framed, fabric-covered slotted ailerons droop automatically when split flaps are lowered. Maximum aileron droop 10°. Flap settings 22° for take-off, 50° for landing. Gross wing area 197.6 sq. ft. (18.36 m.²).

Fuselage.—Warren-type welded steel tube structure covered with fabric aft of front door hinge post.

Tail Unit.—Cantilever monoplane type. Stressed skin construction, the skins of all surfaces being reinforced by Redux-ed internal chordwise stiffeners. Moulded Durestos tips to rudder and elevators form horn balances. Ground-adjustable tab in rudder, controllable trim-tab in port elevator.

Landing Gear.—Fixed tail-wheel type. Single light alloy legs pivoted near upper ends and sprung by Dowty liquid-spring shock absorbers mounted horizontally within box-section extruded shock truss extending across fuselage between landing-gear pick-up points. Goodyear wheels, low-pressure tyres and toe-operated hydraulically-operated single-disc brakes. Fully-castoring levered-suspension tail-wheel unit with Dowty liquid-sprung shock-absorber. Track: 6 ft. 8 in. (2.0 m.).

Power Plant.—One Cirrus Bombardier 203 four-cylinder in-line inverted air-cooled engine rated at 173 h.p. on M.T. fuel. Plessey cartridge type starter. Fairey-Reed fixed-pitch metal airscrew. Main fuel in Marston Excelsior bag-type tank in starboard wing root. Normal fuel capacity 16 Imp. gallons (72.6 litres). For longer range corresponding tank may be fitted in port wing root, and for ferrying an auxiliary tank can be installed in rear fuselage.

Accommodation.—For A.O.P. duties cabin seats pilot on port side and observer in swivel seat to face either fore or aft on centre-line aft. Second front seat and dual controls may be installed alongside pilot. One door on port side, two on starboard side, all easily removable and jettisonable.

Dimensions.—
- Span 36 ft. 5 in. (11.22 m.).
- Length 23 ft. 8½ in. (7.23 m.).
- Height (on ground) 8 ft. 11 in. (2.7 m.).

Weights and Loadings.—
- Weight empty 1,460 lb. (663 kg.).
- Weight loaded (normal A.O.P. operational load including pilot, observer, two radios, full fuel load, etc.) 2,100 lb. (953 kg.).
- Wing loading 10.4 lb./sq. ft. (50.75 kg./m.²).
- Power loading 11.9 lb./h.p. (5.39 kg./h.p.).

Performance (at 2,100 lb. = 953 kg. A.U.W. —estimated).—
- Max. speed 127 m.p.h. (204 km.h.).
- Normal cruising speed 110 m.p.h. (178 km.h.).
- Initial rate of climb 920 ft./min. (280 m./min.).
- Absolute ceiling 18,500 ft. (5,650 m.).
- Range at economic cruise 242 miles (400 km.).
- Take-off run in 6 m.p.h. (9.3 km.h.) wind 108 yds. (99 m.).

The Auster A.O.P. Mk. 9 (173 h.p. Cirrus Bombardier engine).

Take-off to clear 50 ft. (15.25 m.) in 6 m.p.h. (9.3 km.h.) wind 210 yds. (192 m.).
Landing run 60 yds. (55 m.).
Landing distance from 50 ft. (15.25 m.) in 6 m.p.h. (9.3 km.) wind 150 yds. (137 m.).

THE AUSTER B.4 AMBULANCE/FREIGHTER.

The B.4 was designed and built as a private venture to perform the numerous duties, other than that of A.O.P. itself, required of a light military aircraft. It features a large cabin with a loading door at its rear end. The basic floor provides fittings for seats, stretchers or light freight, but this floor is quickly removable and can be replaced by other floors incorporating equipment for other rôles, such as cable-laying, crop-dusting and spraying, air-to-ground broadcasting, etc.

TYPE.—Single-engined General Purpose monoplane.

WINGS.—High-wing rigidly-braced monoplane. Split trailing-edge flaps. Gross wing area 189.75 sq. ft. (17.7 m.²).

FUSELAGE.—Welded steel-tube structure covered with fabric. Forward portion is square, with a triangular wedge roof to which tail boom is bolted. Rear loading door of cabin is of wood.

TAIL UNIT.—Braced monoplane type. Port elevator has controllable trim-tab, rudder and adjustable tab.

LANDING GEAR.—Non-retractable four-wheel type. Main units incorporate Dowty liquid-spring shock-absorbers and Goodyear wheels and hydraulic brakes. The two rear, or tail, wheels also have liquid springs and are fully castoring. Main wheel track 6 ft. 11 in. (2.13 m.).

POWER PLANT.—One 180 h.p. Cirrus Bombardier 702 four-cylinder in-line inverted air-cooled engine driving a Fairey-Reed two-blade metal airscrew. Two bullet-proof fuel tanks, one in each wing root. Total fuel capacity 23 Imp. gallons (105 litres).

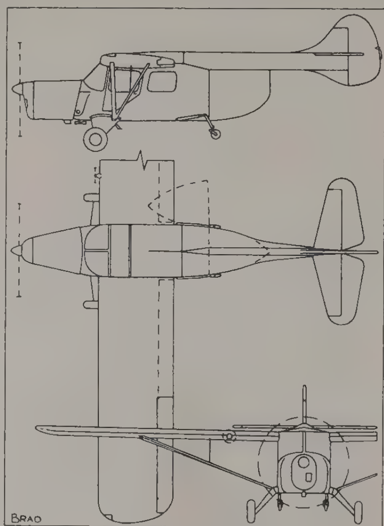
ACCOMMODATION.—Cabin may seat four. All seats except pilot's (port front) removable. Bushes in floor serve as freight lashing and seat and stretcher attachment points. Two stretchers may be carried on starboard side, one above the other, with seat for attendant on port. Floor is secured by six bolts and may be quickly removed and replaced by others with special fittings or equipment attached. Rear loading door hinges to starboard to leave clear opening 30 in. × $38\frac{1}{2}$ in. (93 cm. × 98 cm.). Volume of usable cabin space 110 cub. ft. (3.7 m.³).

DIMENSIONS.—
Span 37 ft. (11.25 m.).
Length 24 ft. 8 in. (7.53 m.).
Height 8 ft. $4\frac{1}{2}$ in. (2.56 m.).

WEIGHTS.—
Weight empty 1,642 lb. (745 kg.).
Payload for max. range 550 lb. (250 kg.).
Weight loaded 2,600 lb. (1,180 kg.).

PERFORMANCE.—
Max. cruising speed 105 m.p.h. (169 km.h.).
Initial rate of climb 730 ft./min. (223 m./min.).
Range 300 miles (480 km.).
Take-off distance to 50 ft. (15.25 m.) (5 m.p.h. = 8 km.h. wind) 415 yds. (380 m.).
Landing distance from 50 ft. (15.25 m.) (5 m.p.h. = 8 km.h. wind) 255 yds (233 m.).

The Auster B.4 with its rear loading door removed



The Auster B.4

THE AUSTER J.1 AUTOCRAT.

TYPE.—Three or four-seat Cabin monoplane.

WINGS.—Strut-braced high-wing monoplane. Incidence (root) $3\frac{3}{4}$ degrees (tip) $2\frac{1}{2}$ degrees; dihedral 1 degree; chord 5 ft. 3 in. (1.60 m.). Wing braced by streamlined steel-tube V-struts on each side. Structure consists of laminated spruce spars, ribs of drawn-section light alloy, steel drag struts and tie-rod internal bracing, metal leading-edge and an overall fabric covering. Ailerons have wooden spars, light alloy nose and ribs and fabric covering. Manually-operated split trailing-edge flaps have steel torsion shaft and light alloy skin. Total aileron area 18 sq. ft. (1.66 m.²). Total flap area 16 sq. ft. (1.47 m.²). Gross wing area 185 sq. ft. (17.14 m.²).

FUSELAGE.—Rectangular-section welded steel-tube structure with fabric covering.

TAIL UNIT.—Braced monoplane type. Welded steel-tube framework with fabric covering. Fixed tailplane. Rudder has trim-tab adjustable on ground. Controllable trim-tab in port elevator. External tie-rod bracing. Tailplane span 10 ft. (3.05 m.). Gross tailplane area 24.72 sq. ft. (2.28 m.²); fin area 5 sq. ft. (0.37 m.²); rudder area 7.25 sq. ft. (0.67 m.²).

LANDING GEAR.—Fixed two-wheel type. Half-axles sprung under centre-line of fuselage rubber-cord shock-absorbers. Dunlop wheels and Bendix brakes. Track 6 ft. 0 in. (1.83 m.). Full-castoring tail-wheel on leaf-spring with solid rubber tyre.

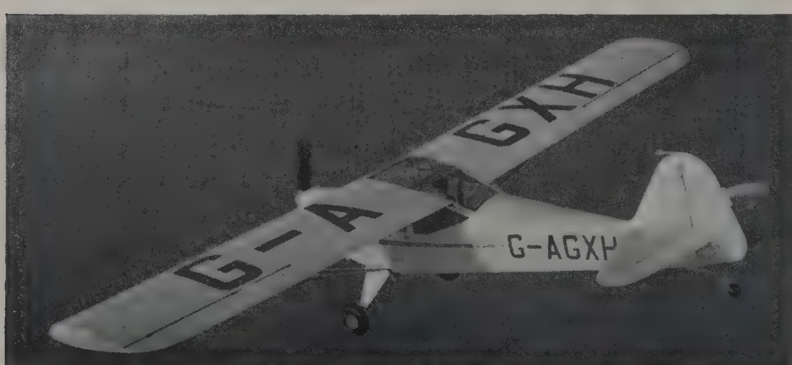
POWER PLANT.—One 100 h.p. Blackburn Cirrus Minor 2 four-cylinder in-line inverted air-cooled engine. Weybridge wood or Fairey-Reed metal airscrew 6 ft. 0 in. (1.83 m.) diameter. Fuel tank between engine and dashboard with capacity of 15 Imp. gallons (68 litres). Auxiliary fuel tank of $13\frac{3}{4}$ Imp. gallons (62.5 litres) capacity may be carried under fuselage. Oil tank of 2 Imp. gallons (9 litres) capacity aft of engine.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls, and one aft on starboard side facing to port or two in rear of cabin facing forward. Backs of front seats hinge forward for access to rear. One-piece moulded Perspex windshield and moulded cabin roof. Access door on each side with sliding windows. Luggage space aft of rear seat with allowance of 300 lb. (136 kg.).

DIMENSIONS.—
Span 36 ft. 0 in. (11.0 m.).
Length 23 ft. 5 in. (7.14 m.).
Height (tail down, airscrew horizontal) 6 ft. 6 in. (1.98 m.)

WEIGHTS AND LOADINGS.—
Weight empty 1,052 lb. (477 kg.)
Fuel and oil 128 lb. (58 kg.).
Equipment 62 lb. (28 kg.).
Pilot, two passengers and luggage 608 lb. (277 kg.).
Weight loaded 1,850 lb. (840 kg.).
Wing loading (fully loaded) 10 lb./sq. ft. (49 kg./m.²).
Power loading (fully loaded; take-off power) 18.5 lb./h.p. (8.5 kg./h.p.).

PERFORMANCE —
Max. speed 120 m.p.h. (193 km.h.).
Cruising speed 100 m.p.h. (161 km.h.).
Stalling speed (with two up and flaps down) 28 m.p.h. (45 km.h.).
Rate of climb (at 1,700 lb. = 801 kg.) 568 ft./min. (180 m./min.).
Ceiling 15,000 ft. (4,750 m.).
Still-air range 320 miles (515 km.).
Still-air range with long-range tank 600 miles (985 km.).
Take-off run in 5 m.p.h. (8 km.h.) wind 150 yds. (137 m.).
Landing run in 5 m.p.h. (8 km.h.) wind 85 yds. (78 m.).
Fuel consumption at 2,300 r.p.m. 4.9 Imp. gallons (22.2 litres) per hr.
Fuel consumption at 2,200 r.p.m. 4.3 Imp. gallons (19.5 litres) per hr.



The Auster J.1 Autocrat (100 h.p. Cirrus Minor 2 engine).

THE AUSTER J.5.

The J.5 is basically similar to the Autocrat but is fitted with the 130 h.p. Gipsy Major 1 engine and long-range tanks. It was originally produced for the Australian and New Zealand market, where the three-seat version is known as the Autocrat and the four-seat version as the Adventurer.

To meet New Zealand Government requirements, a floatplane version of the J.5 was produced and tested in 1951. Apart from having twin Auster floats, this version differs from the landplane in having the larger horn-balanced rudder as fitted to the Aiglet and also an under-fin.

DIMENSIONS.—
Span 36 ft. (11.0 m.).
Length 23 ft. 0 in. (7.01 m.).
Height 8 ft. 8 in. (2.64 m.).
Wing area 185 sq. ft. (17.14 m.²).

WEIGHTS AND LOADINGS.—
Weight empty 1,162 lb. (526 kg.).

Weight loaded (landplane) 2,100 lb. (952 kg.).
Weight loaded (floatplane) 2,300 lb. (1,450 kg.).
Wing loading 11.35 lb./sq. ft. (44.39 kg./m.²).
Power loading 16 lb./h.p. (7.21 kg./h.p.).

PERFORMANCE (landplane at 1,750 lb. = 794 kg. loaded weight).
Max. speed 114 m.p.h. (183 km.h.).
Cruising speed 101 m.p.h. (163 km.h.).
Stalling speed (flaps down) 29 m.p.h. (47 km.h.).
Rate of climb 637 ft./min. (194 m./min.).
Ceiling 12,500 ft. (3,810 m.).
Still air range 375 miles (603 km.).
Take-off run in 5 m.p.h. (8 km.h.) wind 140 yds. (128 m.).
Landing run in 5 m.p.h. (8 km.h.) wind 115 yds. (105 m.).
Fuel consumption at 2,000 r.p.m. 6.3 Imp. gallons (28.6 litres) per hour.

PERFORMANCE (seaplane at 2,300 lb. = 1,450 kg. loaded weight).—
Max. speed 102 m.p.h. (164 km.h.).
Cruising speed 91 m.p.h. (147 km.h.).
Stalling speed (flaps down) 32 m.p.h. (51.5 km.h.).
Initial rate of climb 375 ft./min. (2 m./sec.).
Service ceiling 7,500 ft. (2,340 m.).
Take-off distance 490 yds. (460 m.).
Take-off time 48 seconds.
Landing run 150 yds. (140 m.).
Range 260 miles (420 km.).

The Auster J.5 (130 h.p. D.H. Gipsy Major I engine).

THE AUSTER J.5F AIGLET TRAINER.

The Aiglet Trainer is a two-seat dual-control aerobatic training aircraft which has been designed to fulfil present-day training requirements and to provide maximum usage at lowest cost. The airframe is basically J.5 but the Aiglet Trainer has horn-balanced rudder and elevators and the wings have been clipped to 32 ft. (9.76 m.) to give a greater rate of roll. The side-by-side seats are designed to conform to the aircraft's aerobatic category and the fuselage width has been increased by 4 in. (10.16 cm.) to give a wider cabin.

The Auster Aiglet Trainer as supplied to the Royal Pakistan Air Force.

The J.5F can also be supplied as a three-seat tourer, in which case the aerobatic seats are replaced by standard Auster front seats. The seat for the rear passenger is of the wide forward-facing type.

A 16 Imp. gallon (72.5 litre) fuel tank is provided in the starboard wing root and provision is made for another of similar capacity (long-range) in the port wing.

The Aiglet Trainer is fitted with a 130 h.p. D.H. Gipsy Major 1 engine which drives a Fairey-Reed two-blade metal airscrew.

DIMENSIONS.—
Span 32 ft. (9.76 m.).
Length 23 ft. 2½ in. (7.07 m.).
Height 8 ft. 3 in. (2.52 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,323 lb. (601 kg.).
Weight loaded (Aerobatic two-seater) 1,950 lb. (885 kg.).
Weight loaded (three-seat Tourer) 2,200 lb. (1,000 kg.).
Wing loading 13.45 lb./sq. ft. (65.63 kg./m.²).
Power loading 16.9 lb./h.p. (7.67 kg./h.p.).

PERFORMANCE.—
Max. speed 127 m.p.h. (203 km.h.).
Cruising speed 110 m.p.h. (176 km.h.).
Stalling speed (engine off, full flap) 29 m.p.h. (46.4 km.h.).
Initial rate of climb 705 ft./min. (215 m./min.).
Take-off run (still air) 172 yds. (157 m.).
Cruising range (one tank) 275 miles (440 km.).
Max. cruising range (two tanks) 545 miles (872 km.).

THE AUSTER AUTOCAR.

The Autocar is a four-seat development of the basic Autocrat, with a re-designed fuselage and more powerful engine.

There are three versions of the Autocar, the J.5B with the 130 h.p. D.H. Gipsy Major I engine; and the J.5G and J.5H with the 155 h.p. Cirrus Major 3 and 150 h.p. Cirrus Major 2 engines respectively.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Similar to the Autocrat, but the inboard end of each wing is constructed with steel ribs to house a fuel tank. Gross wing area 185 sq. ft. (17.14 m.²).

FUSELAGE.—Rectangular section welded steel tube structure with fabric covering.

TAIL UNIT.—Braced monoplane type. Welded steel framework with fabric covering. Fixed tailplane. Rudder has trim-tab, adjustable on the ground and is horn-balanced. Controllable trim-tab in port elevator. External tie-rod bracing. Tailplane span 10 ft. (3.05 m.). Gross tailplane area 24.72 sq. ft. (2.28 m.²). Fin area 5.1 sq. ft. (0.47 m.²). Rudder area 10.1 sq. ft. (0.93 m.²).

LANDING GEAR.—Similar to Autocrat, with steerable tail wheel as an optional fitment.

POWER PLANT.—One 130 h.p. Gipsy Major 1 (J.5B) or 150 h.p. Cirrus Major 2 (J.5H) or 155 h.p. Cirrus Major 3 (J.5G) four-cylinder in-line inverted air-cooled engine. Silencer and metal Fairey-Reed airscrew are standard. Fuel tanks in each wing root, total capacity 32 Imp. gallons (145 litres). Oil tank, capacity 3 gallons (13.6 litres) aft of engine.

ACCOMMODATION.—Enclosed cabin seating two side-by-side, with dual controls if required, and two side-by-side at rear of cabin. Backs of front seats hinge forward for access to rear. Luggage space aft of rear seat. One access door in each side with sliding windows.

DIMENSIONS.—
Span 36 ft. 0 in. (11.0 m.).
Length 23 ft. 2 in. (7.1 m.).
Height 7 ft. 6 in. (2.3 m.).

WEIGHTS AND LOADINGS (J.5B Gipsy-Major I engine).—
Weight empty 1,413 lb. (640 kg.).
Weight loaded 2,400 lb. (1,089 kg.).
Wing loading 13 lb./sq. ft. (63 kg./m.²).
Power loading 18.5 lb./h.p. (8.25 kg./h.p.).

WEIGHTS AND LOADINGS (J.5G and J.5H Cirrus Major engine).—
Weight empty 1,367 lb. (621 kg.).
Weight loaded 2,450 lb. (1,112 kg.).
Wing loading 13.3 lb./sq. ft. (64.9 kg./m.²).
Power loading 15.8 lb./h.p. (7.17 kg./h.p.).

PERFORMANCE (J.5B Gipsy-Major I engine).—
Max. speed 116 m.p.h. (186 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Stalling speed (flaps down) 34 m.p.h. (55 km.h.).
Stalling speed (flaps up) 42 m.p.h. (67.6 km.h.).
Rate of climb 525 ft./min. (2.66 m./sec.).
Service ceiling 11,000 ft. (2.352 m.).
Absolute ceiling 13,000 ft. (3,962 m.).
Still air range 500 miles (805 km.).
Take-off run (5 m.p.h. = 8 km.h. wind) 211 yds. (192 m.).
Take-off distance to 50 ft. (15.2 m.) 537 yds. (490 m.).
Landing run (5 m.p.h. = 8 km.h. wind) 163 yds. (159 m.).

PERFORMANCE (J.5G and J.5H Cirrus Major engine).—
Max. speed 127 m.p.h. (203 km.h.).
Cruising speed 110 m.p.h. (176 km.h.).
Stalling speed (flaps down) 36 m.p.h. (57.6 km.h.).
Initial rate of climb 710 ft./min. (216.5 m./min.).
Service ceiling 14,000 ft. (4,270 m.).
Absolute ceiling 16,200 ft. (4,940 m.).
Still air range 485 miles (775 km.).
Take-off run (5 m.p.h. = 8 km.h. wind) 175 yds. (160 m.).
Take-off distance to 50 ft. (15.2 m.) 320 yds. (293 m.).
Landing run (5 m.p.h. = 8 km.h. wind) 130 yds. (120 m.).

An Auster J.5G Autocar (155 h.p. Cirrus Major 3 engine) as supplied to the Royal Australian Navy for liaison duties.

AVIATION TRADERS

AVIATION TRADERS (ENGINEERING), LTD.

Head Office: 15, Great Cumberland Place, London, W.1.

Works: Stansted and Southend Airports, Essex.

Directors: F. A. Laker (Managing) and J. M. Laker.

General Manager: W. E. Brown, A.R.Ae.S.

Chief Designer: L. C. Heal, A.F.R. Ae.S.

Commercial Manager: R. Edwards.

Engineering Manager: J. Wiseman.

Aviation Traders (Engineering), Ltd. was formed in 1949 to undertake the overhaul and maintenance of aircraft and was used to maintain the air transport fleet of its associated company Air Charter Ltd. The company has since developed a factory organisation to manufacture and assemble aircraft and aircraft components.

The company has developed the Heal method of tensioned-skin construction and a twin-engined transport known as the Accountant has been designed to incorporate this method of construction. A prototype is being built at the company's works on the Southend Municipal Airport.

A model of the Aviation Traders Accountant.

THE AVIATION TRADERS ACCOUNTANT.

The Accountant is the first aircraft to be designed to make use of the Heal system of tensioned-skin construction. This system is particularly suitable for the fabrication of components which have smooth double-curvature surfaces for all or most of their length and, it is claimed will, in addition to other benefits, reduce manufacturing costs.

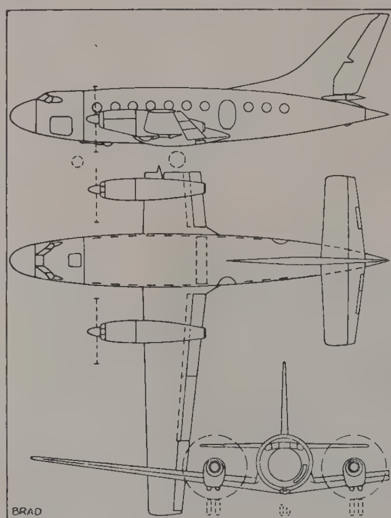
Type.—Twin-engined medium Transport designed as a replacement for the DC-3.

Wings.—Low-wing cantilever monoplane. Aspect ratio 10.77. All-metal two-spar structure in two units joined on centre-line of fuselage, loads being transferred through skin attachment over whole chord between spars. Double slotted flaps with central split flap for landing only. Gross wing area 632 sq. ft. (58.7 m.^{2}).

Fuselage.—Circular section all-metal stressed-skin structure, panels running longitudinally and giving tension and stiffness by Heal method of construction. Nose section hinged immediately aft of flight compartment. Fuselage pressurised over whole length at 5.5 lb./sq. in. (0.38 kg./cm.^{2}) differential, equivalent to 8,000 ft. (2,440 m.) conditions at 25,000 ft. (7,625 m.).

Tail Unit.—Cantilever monoplane type. Two-spar all-metal tailplane and fin. Alclad covered rudder and elevator with trim tabs. Total vertical tail area 198 sq. ft. (18.4 m.^{2}). Total horizontal tail area 169 sq. ft. (15.7 m.^{2}). Tailplane span 26 ft. 2 in. (7.98 m.).

Landing Gear.—Retractable Dowty nose-wheel type. All units fitted with twin wheels and tyres at 55 lb./sq. in. (4.21 kg./cm.^{2}) maximum pressure. Nose-wheel steerable. Main wheels have independent Maxaret controlled brakes. Wheel base 15 ft. 2 in. (4.62 m.). Main wheel track (between oleo leg centres) 21 ft. 8 in. (6.60 m.).



The Aviation Traders Accountant.

Power Plant.—Two 1,600 s.h.p. Rolls-Royce Dart RDa.6 turboprop engines. Four-blade feathering and braking airscrews 10 ft. (3.05 m.) in diameter. Provision for fitment of water-methanol system but this will only be required under exceptional operating conditions. Entire fuel capacity within wing structure outboard of engines, 340 Imp. gallons (1,540 litres) minimum, 1,080 Imp. gallons (4,900 litres) maximum. Normal fuel capacity 550 Imp. gallons (2,500 litres).

Accommodation.—Flight compartment for two pilots, with separate station for radio-operator/navigator. Radio and radar operated by second pilot by remote control when navigator is not carried. Main cabin floor, flat and level throughout, is 32 ft. 3 in. (9.83 m.) long, with maximum width of 6 ft. 9 in. (2.0 m.). Maximum fuselage width 8 ft. (2.44 m.) inside. Passenger accommodation may range from 22 with stewardess, buffet and coat stowage, etc., to 36 in high-density version with stewardess. All arrangements catered for in normal floor design using standard type of backward-facing double seat, all seats spaced at 36½ in. (92.7 cm.) pitch. Seats may be folded to cabin sides when freight is carried. Hinged nose with automatic disengagement and locking of controls, provides clear access for large and long articles of freight. Post, shafting, etc. up to 43 ft. (13.1 m.) long can be accommodated. A movable bulkhead provides for a wide variation of passenger/freight loads.

Dimensions.—
- Span 82 ft. 6 in. (25.16 m.).
- Length 60 ft. 6 in. (18.60 m.).
- Height (over fin) 24 ft. 7 in. (7.50 m.).

Weights and Loadings.—
- Weight empty equipped 15,020 lb. (6,820 kg.).
- Min. payload (1,850 mile = 2,960 kg. stage length) 2,868 lb. (1,302 kg.).
- Max. payload (230 mile = 368 kg. stage length) 8,880 lb. (4,031 kg.).
- Disposable load 12,440 lb. (5,648 kg.).
- Initial T.O. weight 28,000 lb. (12,712 kg.).
- Normal wing loading 44.3 lb./sq. ft. (216.18 kg./m.^{2}).
- Normal power loading 8.7 lb./e.s.h.p. (3.95 kg./e.s.h.p.).

Performance (I.S.A. conditions at 28,000 lb. = 12,712 kg. A.U.W. estimated).—
- Cruising speed at 15,000 ft. (4,575 m.) 280 m.p.h. (448 km.h.).
- Cruising speed at 25,000 ft. (7,625 m.) 277 m.p.h. (443 km.h.).
- Rate of climb at S/L. 1,532 ft./min. (467 m./min.).
- Climb to 10,000 ft. (3,050 m.) 7.3 min.
- Climb to 20,000 ft. (6,100 m.) 18.1 min.
- Climb to 25,000 ft. (7,625 m.) 26.3 min.
- Take-off distance to 50 ft. (15.25 m.) on one engine 3,300 ft. (1,005 m.).
- Landing distance from 50 ft. (15.25 m.) 2,200 ft. (6.70 m.).
- Runway length required for T.O. 3,160 ft. (964 m.).
- Runway length required for landing 3,140 ft. (958 m.).

AVRO

A. V. ROE & CO., LTD.

Head Office: Greengate, Middleton, Manchester.

London Office: 18, St. James's Square, W.1.

Directors: Sir Frank Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman); Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S.; Sir Roy H. Dobson, C.B.E., F.R.Ae.S. (Managing Director); Sir William Farren, C.B., M.B.E., M.A., F.R.S., M.I.Mech.E., F.R.Ae.S. (Technical Director); C. E. Fielding, O.B.E., F.R.Ae.S., M.I.P.E. (Production); S. G. Joy (Secretary and Director); J. A. R. Kay, A.F.R.Ae.S. (Sales Director); and J. Green, O.B.E. (Controller-General, Engineering).

Chief Designer: J. R. Ewans, A.C.G.I., B.Sc., D.I.C., A.F.R.Ae.S.

A. V. Roe & Co. was formed in 1910, when the firm advertised itself as constructors of aeroplanes and accessories, and was probably the first firm in Great Britain to do so. The limited company was formed in January, 1913. On the amalgamation of the Hawker and Siddeley interests in 1935, the Avro Company, which formerly was a member of the Siddeley group, became a member of the group of companies controlled by the Hawker Siddeley Group.

In recent years the Avro company has been engaged in an extensive programme of delta-wing research with the 707 Series of aircraft, culminating in the Avro 698 Vulcan bomber, which is now in production for the Royal Air Force.

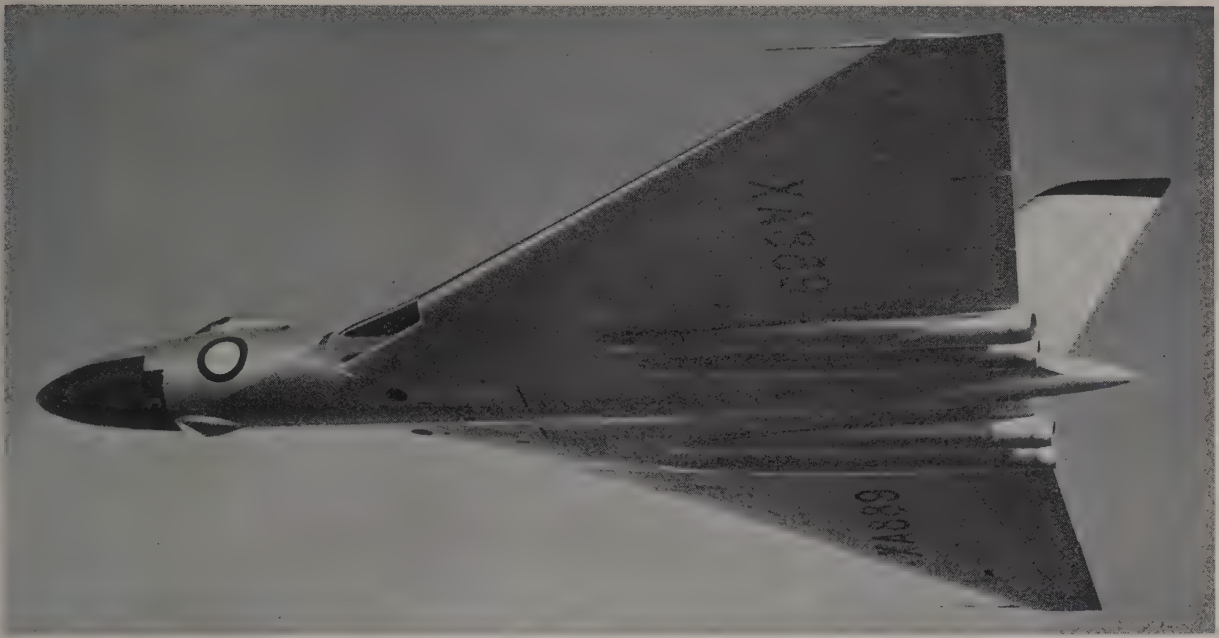
Also in production is the Shackleton four-engined long-range maritime reconnaissance aircraft, which is now in operational service in R.A.F. Coastal Command.

Early in 1955 A. V. Roe completed their production programme of the English Electric Canberra twin-jet bomber under contract with the Ministry of Supply. The first Avro-built Canberra flew on November 25, 1952.

THE AVRO TYPE 707.

The Avro 707 was the first British aeroplane designed for delta-wing research. Powered by a single Rolls-Royce Derwent gas-turbine, the first 707 made its first flight at Boscombe Down on September 4, 1949. This aircraft was later destroyed in an accident.

A second prototype for low-speed research and known as the Avro 707B, made its



The Avro Vulcan B. Mk. I Delta-wing Bomber (four Bristol Olympus turbojet engines).

first flight on September 6, 1950, at Boscombe Down, and a third high-speed prototype, the 707A, flew for the first time in June, 1951. A second 707A made its maiden flight on February 20, 1953.

A fourth prototype, the 707C, is a two-seat side-by-side dual control research version of the 707A. It flew for the first time on July 1, 1953.

The 707 is a mid-wing monoplane, with the pilot's cockpit located in the nose forward of the triangular wing. In the 707B the air intakes for the engine are positioned well back along the top surface of the fuselage, whereas in the 707A and 707C the intakes are located in the wing roots.

Dimensions.—
Span (707A and 707C) 34 ft. 2 in. (10.4 m.).
Span (707B) 33 ft. 0 in. (10.1 m.).
Length overall (all models) 42 ft. 4 in. (12.9 m.).
Height (707A) 11 ft. 7 in. (3.53 m.).
Height (707B) 11 ft. 9 in. (3.58 m.).

THE AVRO TYPE 698 VULCAN.

The Vulcan, the first jet bomber to employ the delta wing configuration, is the result of extensive research work with the Avro 707A and 707B.

The first prototype Vulcan (VX770) powered by four Rolls-Royce Avon turbojet engines, flew for the first time on August 30, 1952, but this aircraft is now fitted with four Armstrong Siddeley Sapphire engines. A second prototype (VX777) powered by four Bristol Olympus turbojet engines made its initial flight on September 3, 1953.

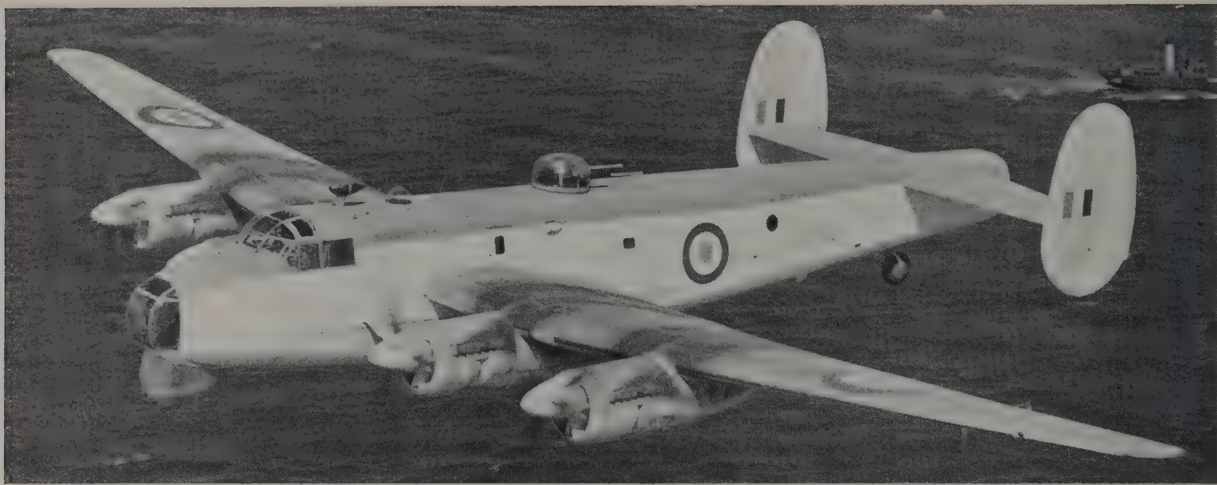
The Vulcan is in production, and the first Vulcan B. Mk. 1 (XA889), powered by four Bristol Olympus turbojet engines, flew on February 4, 1955.

Dimensions.—
Span 99 ft. (30.15 m.).
Length 97 ft. 1 in. (29.61 m.).
Height 26 ft. 6 in. (8.08 m.).

THE AVRO TYPE 696 SHACKLETON.

The Shackleton is now in service in R.A.F. Coastal Command in both the Mk. 1 and Mk. 2 forms. The Mk. 3 is in production.

The Avro family of delta-wing prototypes, comprising the two Type 698 Vulcan bomber prototypes and the two Type 707A, the Type 707B and Type 707C research aircraft.



The Avro Shackleton M.R. Mk. I Maritime Reconnaissance Monoplane (four 2,450 h.p. Rolls-Royce Griffon 67 engines).

Shackleton M.R. Mk. 1. First production version. General description below refers specifically to this mark. Prototype first flew on March 9, 1949.

Shackleton M.R. Mk. 2. More powerfully armed and cleaner version of Mk. 1. New nose with two additional 20 mm. cannon aimed by gunner who sits above bomb-aimer. Fixed under-nose radome of Mk. 1 deleted and replaced in Mk. 2 by retractable radome located under fuselage aft of bomb-bay. Rear fuselage faired off with transparent terminal cone to provide look-out position. Single-fixed tail-wheel of Mk. 1 replaced by twin retractable wheels. The Mk. 2 prototype flew for the first time on June 17, 1952. Dimensions : Span same as for Mk. 1. Length 87 ft. 4 in. (26.6 m.). Height 16 ft. 9 in. (5.1 m.).

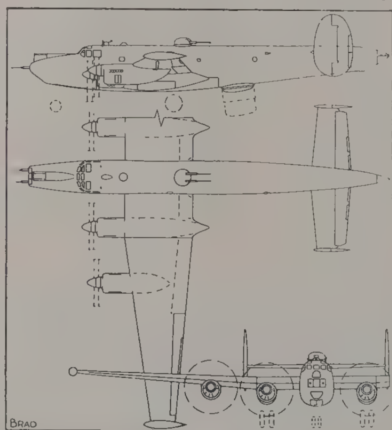
Shackleton M.R. Mk. 3. Developed version of Mk. 2. Nose-wheel landing-gear ; increased fuel capacity ; new clear-view cockpit canopy ; internal changes for increased crew comfort, etc. In production for Royal Air Force and South African Air Force. This version is shown in the three-view drawing alongside.

Type.—Four-engined Long-range Maritime Reconnaissance monoplane.

Wings.—Cantilever mid-wing monoplane. Wing root aerofoil NACA 23018. Incidence 4°. Dihedral on outer planes (true) 4°. Two-spar all-metal structure. Hydraulically-operated split trailing-edge flaps, two between fuselage and inner nacelles, and two outboard of inner nacelles. Total flap area 187.3 sq. ft. (17.40 m.^{2}). Ailerons in outer wing panels, with trim and balance tabs in each. Total aileron area 113.4 sq. ft. (10.55 m.^{2}). Gross wing area 1,421 sq. ft. (132.4 m.^{2}). T.K.S. porous-metal leading-edge de-icing.

Fuselage.—Light-alloy stressed skin semi-monocoque structure.

Tail Unit.—Cantilever monoplane tail and end-plate fins and rudders. All-metal structure. Total tailplane area 285.4 sq. ft. (26.6 m.^{2}). Elevator area (including tabs) 87.30 sq. ft. (8.13 m.^{2}). Trim tab area (two) 3.56 sq. ft. (0.331 m.^{2}). Balance tab area (two) 3.54 sq. ft. (0.329 m.^{2}). Total vertical tail area 223 sq. ft. (20.75 m.^{2}). Total rudder area (including combined balance/trim tabs) 100.2 sq. ft. (9.5 m.^{2}). T.K.S. porous-metal leading-edge de-icing.



The Avro Shackleton M.R. Mk. 3.

Landing Gear.—Retractable tail-wheel (Mks. 1 and 2) or nose-wheel (Mk. 3) type. Main wheels each carried between two oleo-pneumatic shock-absorbing legs, retract backward hydraulically into inner engine nacelles. Single fixed (Mk. 1) or dual retractable (Mk. 2) tail-wheel unit.

Power Plant.—Four 2,450 h.p. Rolls Royce Griffon 67 twelve-cylinder Vee liquid-cooled engines, each driving a de Havilland six-blade co-axial counter-rotating constant-speed fully-feathering airscrew, diameter 13 ft. (3.96 m.).

Accommodation.—Crew of ten. Pilot's compartment in forward fuselage section, seating two side-by-side. Other crew positions in nose and fuselage.

Armament.—Two 20 mm. cannon in Bristol B.17 dorsal turret. Large single bomb compartment can accommodate variety of anti-shipping weapons in many combinations. Equipment includes extensive radio and radar, provision for carrying A/S.R. lifeboat, etc.

Dimensions.—
Span 120 ft. 0 in. (36.6 m.).
Length (Mk 1.) 77 ft. 6 in. (23.6 m.).
Length (Mk. 2) 87 ft. 4 in. (26.6 m.).
Height (Mk. 1) 17 ft. 6 in. (5.3 m.).
Height (Mk. 2) 16 ft. 9 in. (5.1 m.).

Weights and Performance.—
No data available.

The Avro Shackleton M.R. Mk. 2 Maritime Reconnaissance Monoplane (four 2,450 Rolls-Royce Griffon 67 engines).

BLACKBURN

BLACKBURN & GENERAL AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: BROUGH, EAST YORKS.

SCOTTISH WORKS: CASTLE ROAD, DUMBARTON.

LONDON OFFICE: 43, BERKELEY SQUARE, LONDON, W.1.

Directors: R. Blackburn, O.B.E., A.M.I.C.E., M.I.Mech.E., F.R.Ae.S. (Chairman), E. Turner, A.C.A. (Managing Director), Major F. A. Bumpus, B.Sc., A.R.C.S., Wh.Sc., F.R.Ae.S., N. E. Rowe, C.B.E., B.Sc., M.I.Mech.E., F.R. Ae.S., Whit.Ex., Sir Maurice Bonham Carter, K.C.B., K.C.V.O., Marshal of the Royal Air Force Sir John Slessor, G.C.B., D.S.O., M.C., W. A. Hargreaves, M.B.E., A.M.I.C.E., F.R.Ae.S. and Air Vice-Marshal H. N. Thornton, C.B.E.

Secretary: R. H. Stone, A.C.A.

Technical Advisor: G. E. Petty, F.R.Ae.S., M.I.Mech.E.

Chief Designer: B. P. Laight, A.F.R.Ae.S.

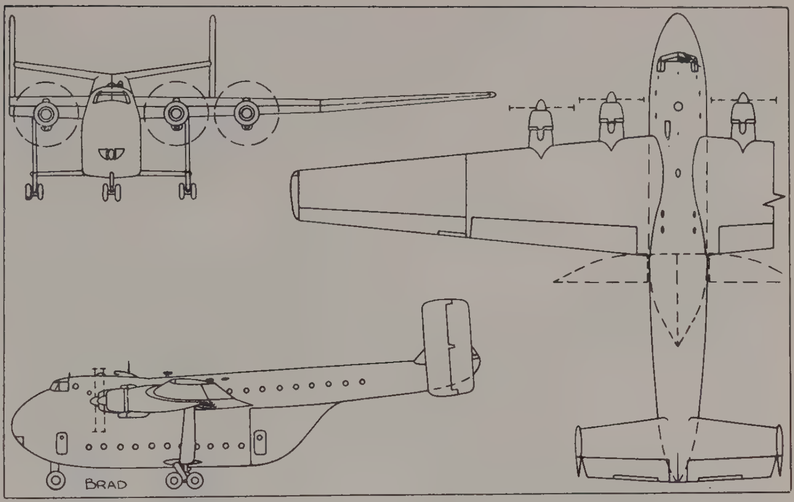
The Blackburn Aeroplane Company was founded by Mr. Robert Blackburn, who designed, built and flew his first aeroplane in 1909 and has continued to manufacture aircraft ever since.

In 1930 the Cirrus Hermes Engineering concern was taken over and Blackburns thus added Cirrus aero-engines to their range of products. In 1936 the public company of Blackburn Aircraft Ltd. was formed.

In the same year, the Blackburn Company came to an arrangement with the famous Scottish shipbuilding company of William Denny & Bros. Ltd., of Dumbarton, to organize and operate jointly a factory on the Clyde. In 1947 this company became a separate subsidiary under the title of Blackburn (Dumbarton) Ltd.

In January, 1949, Blackburn Aircraft, Ltd. merged with General Aircraft, Ltd. of Feltham, Middlesex.

Blackburn and General Aircraft has concentrated on the development of the Universal four-engined freighter, the design of which was inherited from General Aircraft. The first prototype Universal was completed at Brough and has been engaged in development flying since June, 1950. A higher-powered second prototype flew for the first time in June, 1953, and a military version of this heavy transport has been ordered for the R.A.F. as the Beverley C. Mk. 1. Its development as a civil aircraft continues.



The Blackburn and General Beverley Military Transport.

Details of the Cirrus Engine Division of Blackburn and General Aircraft, Ltd. will be found elsewhere. The British manufacturing rights for Turbomeca gas-turbines were acquired by Blackburn and General In October, 1952.

THE BLACKBURN AND GENERAL TYPE 60 UNIVERSAL.

The Type 60, the first prototype Universal, was basically a General Aircraft design (G.A.L.60), work on which started in 1946 before the two companies merged.

This prototype, which was built to the order of the Ministry of Supply, was completed by Blackburn and General at Brough and flew for the first time on June 20, 1950. The Type 60, powered by four 2,020 h.p. Bristol Hercules 730 engines, has been fully described in previous editions of this Annual.

THE BLACKBURN AND GENERAL TYPE 65 UNIVERSAL.

The Type 65, the second prototype Universal, which flew for the first time in June, 1953, is powered by four Bristol Centaurus engines and other modifications include a revised tail-boom and dihedral on the outer wings. This aircraft has since been fitted with a production type centre-section on which the engines are spaced further apart so that the production 16 ft. 6 in. (5.03 m.) diameter airscrews could be fitted. Certain production equipment has also now been fitted, and this aircraft is therefore known as the Beverley prototype.

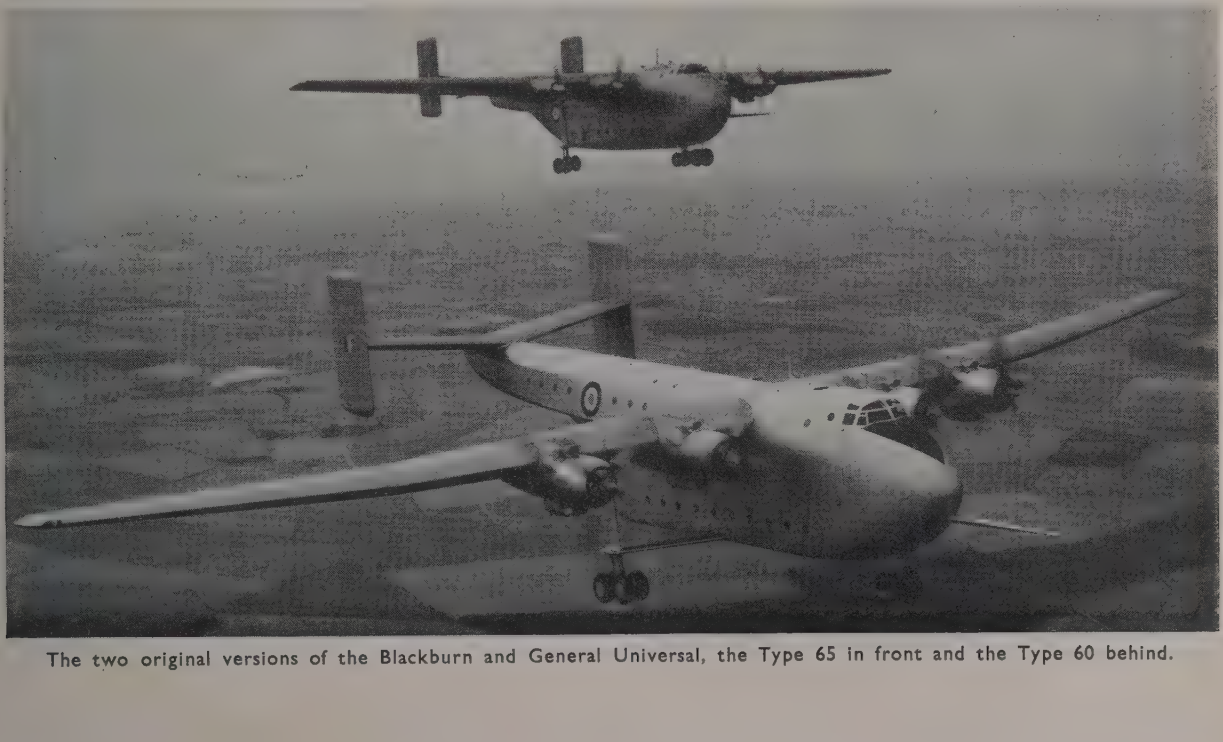
THE BLACKBURN BEVERLEY.

The Beverley is the production military version of the Universal. The first announced order for the Beverley was for twenty, but it has been stated that this quantity has since been increased.

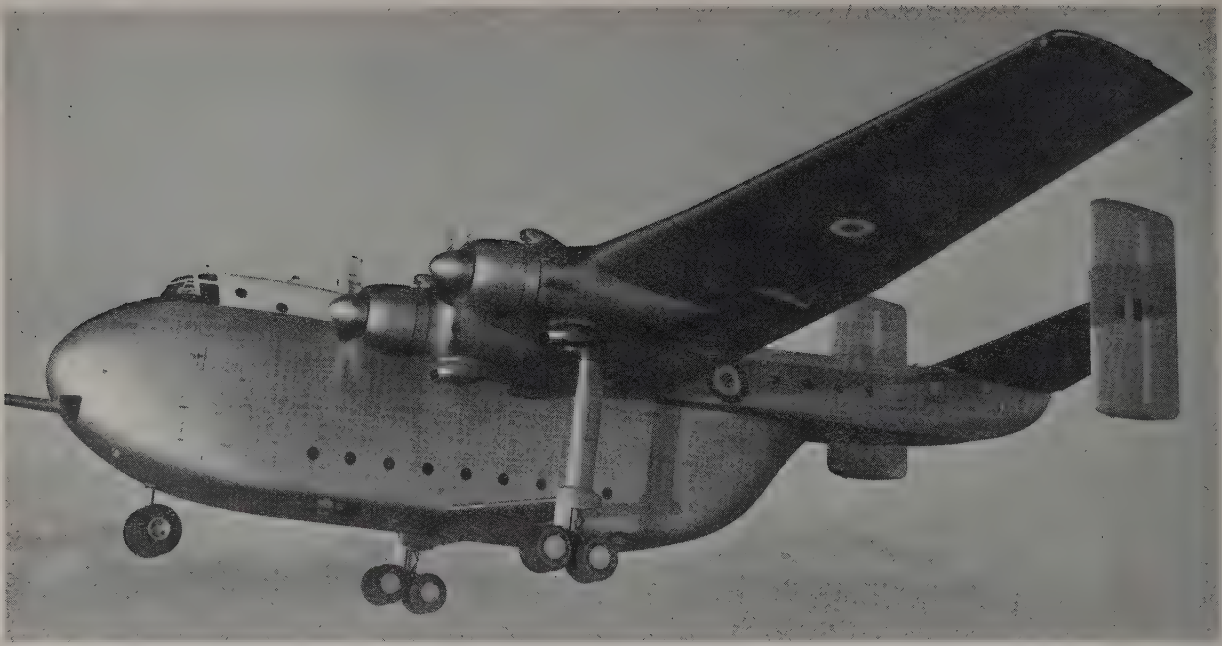
The first production Beverley C. Mk. 1 made its maiden flight on January 29, 1955. It has been announced that the Beverley will go into R.A.F. squadron service in the Summer of 1955.

TYPE.—Heavy Freight and/or Troop Transport and Tactical Support aircraft for the dropping of heavy stores and parachute troops.

WINGS.—High-wing cantilever monoplane. Modified R.A.F. 34 wing section. Aspect ratio 9. Dihedral 0°54′ inner wings, 3°54′ outer wings. Chord 25 ft. 8 in. (7.84 m.) at root (on centre-line), 10 ft. 6 in. (3.2 m.) at tip. All-metal light alloy structure. Wing in four main sections, two inner and two outer, plus detachable



The two original versions of the Blackburn and General Universal, the Type 65 in front and the Type 60 behind.



The Blackburn and General Beverley Military Transport (four 2,850 h.p. Bristol Centaurus engines).

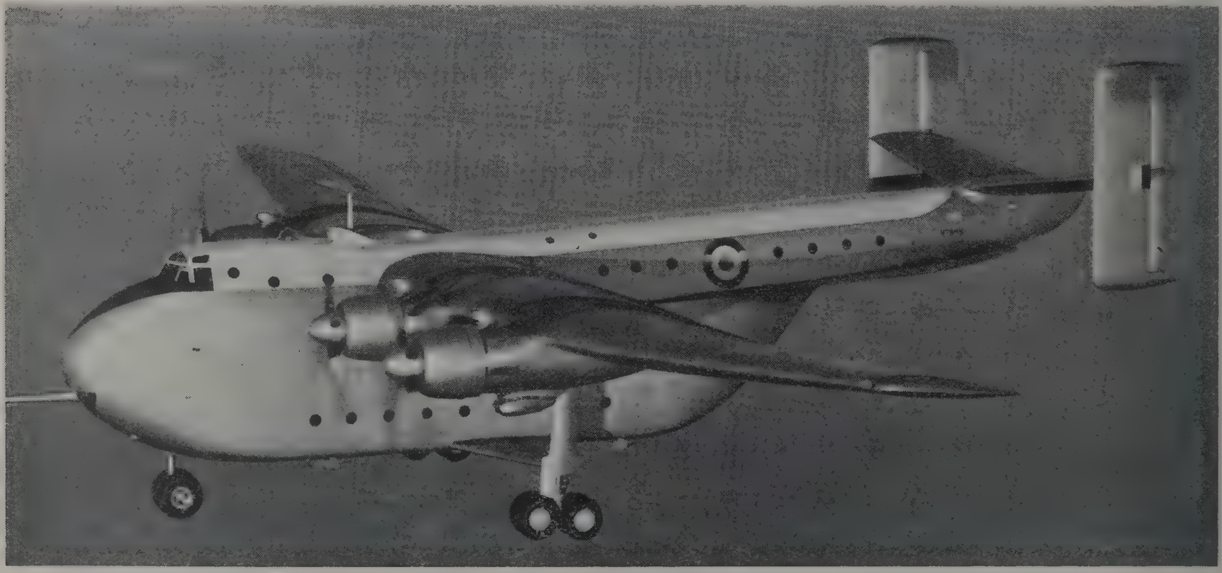
tips, with no centre section. Main spar at 25% chord and rear spar at 55% chord. Warren-girder type ribs, widely spaced. Longitudinal stringers reinforce skin except over two outer fuel cells, where chord-wise beams are used. Thermal leading-edge de-icing. NACA slotted trailing-edge flaps over inner wing sections. Electric infinitely-variable flap operation. Modified Frise type ailerons, with trim and balance tabs on both sides. Push-pull torque control system, combining aileron and trim controls in single run. Fairey hydraulic power-control units. Flap area (each) 189 sq. ft. (17.5 m.²). Aileron area (aft of hinge) (each) 84 sq. ft. (7.8 m.²). Tab area (aft of hinge) (each) 5.5 sq. ft. (0.51 m.²). Gross wing area 2,916 sq. ft. (270 m.²).

Fuselage.—All-metal light-alloy structure in four sections; nose compartment, main freight compartment, crew compartment, and tail boom compartment. Main freight and nose compartments have built-up frames, heavily re-inforced floor and closely-spaced lengthwise stringers to stiffen the skin. Skin and stringer construction of crew compartment with light channel-section frames, and tail boom roof and rear fuselage similar with addition of extruded section stringers. Rear end of main freight compartment closed by pair of clamshell doors.

Tail Unit.—Cantilever monoplane tailplane with outrigged fins and rudders. De-icing equipment in leading-edges. Dihedral on tailplane 7° 34′. Two-spar tailplane with pressed sheet ribs. Fin construction similar. Elevators and rudders are single-spar structures with pressed sheet ribs, all metal-covered. Trim-tabs in all surfaces. Control systems for rudders and elevators operate the elevator and rudder tabs respectively. Gross tailplane and elevator area 526 sq. ft. (48.9 m.²). Total elevator area (aft of hinge) 145.15 sq. ft. (13.45 m.²). Trim tab area each 7.41 sq. ft. (0.687 m.²). Gross fin and rudder area 391.2 sq. ft. (36.3 m.²). Total rudder area (aft of hinge) 62.4 sq. ft. (5.79 m.²). Trim tab area each 6.26 sq. ft. (0.585 m.²). Tailplane span 43 ft. 2 in. (15.10 m.).

Landing Gear.—Fixed nose-wheel type with four-wheel bogie main units. Main Lockheed shock-absorber units attached to wings at upper ends and supported by horizontal sponsons from bottom corners of fuselage frames. Two built-up spars converging at shock-absorber leg in each light-alloy covered sponson. Twin Dunlop nose wheels sprung by Lockheed shock-absorber leg. Nose-wheel unit can be power-steered through an angular movement of ± 45°. Main wheels mounted on beam which is pivoted on main shock-absorber and sprung by Lockheed damper strut. Normal wheels have tyres with pressure of 80 lb./sq. in. Alternative wheels for operation from soft strips may be substituted. These have a pressure of 48 lb./sq. in., the tyres being identical to those used on the nose wheel. Hydraulic differential braking on main wheels, which incorporate the Maxaret non-skid system. Wheelbase (between C/L of struts) 28 ft. 8 in. (8.74 in.). Track (between C/L of struts) 33 ft. 5in. (10.18 m.).

Power Plant.—Four Bristol Centaurus 173 eighteen-cylinder radial air-cooled engines with single-speed superchargers, each developing 2,850 h.p. for take-off at 2,800 r.p.m. with water/methanol injection. Rated powers; normal climb and continuous rich mixture cruising, 2,390 h.p. at 4,500 ft. (1,370 m.); lean mixture continuous cruising 1,720 h.p. at 11,500 ft. (3,500 m.). Access to equipment in engine nacelles (not to power-units) in flight or for ground maintenance through rear auxiliary bulkhead from internal wing crawlway. D.H. four-blade hollow steel reversible-pitch braking airscrews 16 ft. 6 in. (5.03m.) diameter, with electric de-icing. Fuel is carried in eight flexible tanks, four in each wing. Capacities are: No. 1 tanks 1,040 Imp. gallons (4,720 litres) each, No. 2 tanks 1,140 Imp. gallons (5,180 litres) each, No. 3



The Blackburn and General Beverley Military Transport (four 2.850 h.p. Bristol Centaurus engines).

tanks 660 Imp. gallons (2,970 litres) each, No. 4 tanks 600 Imp. gallons (2,720 litres) each. Total fuel capacity 6,880 Imp. gallons (31,300 litres). No. 2 tanks are bullet-proof and Nos. 1 and 2 tanks have fire-extinguishers. Pressure fuelling and de-fuelling is provided for all tanks from points on the fuselage sides at the sponson leading-edge.

ACCOMMODATION.—Flight deck laid out for crew of four, two pilots, radio operator and navigator. Sighting position for supply dropping in extreme nose and despatchers' positions are provided adjacent to parachute exits. Main freight compartment is 40 ft. long, 10 ft. high and 10 ft. wide (12.2 m. × 3.05 m. × 3.05 m.), and the tail compartment is 44 ft. long, 6 ft. high and 8 ft. 6 in. wide (13.4 m. × 1.83 m. × 2.59 m.). Floors of both compartments have flush lashing points/seat attachments on a 20-inch grid and lashing rings and rails are provided on walls of the main freight compartment. Floor of main freight compartment stressed for a loading of 325 lb./sq. ft., with reinforcement for wheeled vehicles with an axle load of up to 12,500 lb. (5,675 kg.). The following are the standard complements :—Troops 94 (58 in freight and 36 in tail compartments), Paratroops 70 (40 in freight and 30 in tail compartments), Ambulance 82 (48 stretcher cases in freight and 34 sitting cases in tail compartments). Heavy drop platform retaining and release gear is provided for individual loads of up to 25,000 lb. (11,350 kg.) and divided loads of up to full military load. The rear fairing doors are removed for dropping operations. Hinged loading ramps at rear of freight floor may be removed when not required.

DIMENSIONS.—
Span 162 ft. (49.5 m.).
Length 99 ft. 5 in. (30.3 m.).
Height overall 38 ft. 5 in. (11.7 m.).

WEIGHTS.
Basic weight (normal equipment) 82,100 lb. (37,273 kg.).
Payload, fuel and oil 52,900 lb. (24,020 kg.).
Gross weight 135,000 lb. (61,200 kg.).

PERFORMANCE (Estimated at 135,000 lb.—61,200 kg.).
Max. speed 238 m.p.h. (384 km.h.) at 5,700 ft. (1,740 m.).
Max. continuous cruising speed 223 m.p.h. (359 km.h.) at 5,000 ft. (1,525 m.).
Max. lean mixture cruising speed 194 m.p.h. (312 km.h.) at 12,500 ft. (3,800 m.).
Recommended cruising speed 175 m.p.h. (282 km.h.) at 8,000 ft. (2,440 m.).

BOULTON PAUL

BOULTON PAUL AIRCRAFT, LTD.

HEAD OFFICE, WORKS AND AERODROME : WOLVERHAMPTON.

LONDON OFFICE : KINNAIRD HOUSE, 1, PALL MALL EAST, S.W.1.

Incorporated : June, 1934.

Chairman and Managing Director : J. D. North, F.R.Ae.S., M.I.Mech.E., F.S.S.

Directors : J. Kissane, C.A., R. Beasley (General Manager), G. C. Haynes, A.C.A. (Secretary) and F. F. Crocombe, B.Sc., A.C.G.I., D.I.C., F.R.Ae.S. (Chief Engineer).

Boulton Paul Aircraft Ltd. was formed in 1934 to take over the old-established Aircraft Department of Boulton & Paul Ltd. of Norwich which began the manufacture of aircraft in 1915.

In addition to the design and construction of aircraft, Boulton Paul has also designed and produced an extensive range of electro-hydraulically operated gun-turrets. More recently, the company has specialised in the development of electronic aids to research, testing and design. It has also developed high-fidelity-power control systems for aircraft and its power units are incorporated in the Vickers Valiant and Avro Vulcan bombers, the Vickers Type 1000 transport and others.

The first aircraft produced by the company after the War was the Balliol, and this type is now in service with the R.A.F. and the Royal Navy.

THE BOULTON PAUL P.108 BALLIOL.

The P.108 was originally designed as an all-purpose advanced trainer to be fitted with an Armstrong Siddeley Mamba or Rolls-Royce Dart airscrew turbine engine.

The type was subsequently named Balliol, and the following three major versions have since appeared.

Balliol T. Mk. 1. This designation applied to the original three-seat training version with an Armstrong-Siddeley Mamba turboprop engine. The first of two prototypes made its first flight on March 24, 1948.

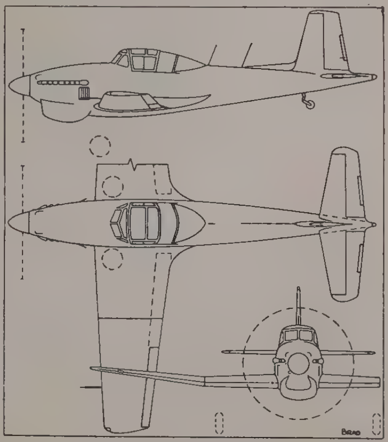
Balliol T. Mk. 2. This mark was developed when the R.A.F. requirements for training aeroplanes were modified. It is powered by a Rolls-Royce Merlin 35 engine, and the third seat of the Mk.1 is deleted. Otherwise, the two versions are the same in all essentials. The first Balliol T.Mk.2 made its first flight on July 10, 1948. In service with the Royal Air Force.

Sea Balliol T. Mk. 21. One Rolls-Royce Merlin 35 engine. A naval version of the Balliol T. Mk. 2 ordered by the Royal Navy. Special features of the Sea Balliol include an arrester hook, smaller diameter airscrew, strengthened landing-gear and changed instruments and equipment.

The following description refers primarily to the Balliol T. Mk. 2.

TYPE.—Two-seat Advanced Trainer.

WINGS.—Cantilever low-wing monoplane. Wing section NACA 65. Mean thickness/chord ratio 18.5. All-metal stressed skin two-spar structure. Outer wing sections fold upwards. Split flaps and dive brakes are operated pneumatically. Ailerons are interchangeable from port to starboard. Wing tips quickly detachable. Access panels at all servicing points. Gross wing area 250 sq. ft. (23.2 m.²).



The Boulton Paul Balliol T. Mk. 2.

FUSELAGE.—Circular section structure ; nose portion built up of light alloy and steel tubes with quickly detachable fairing panels: remainder light alloy stressed skin monocoque. The fuselage breaks down into four unit sections for transport and quickly removable access panels are provided at all servicing points.

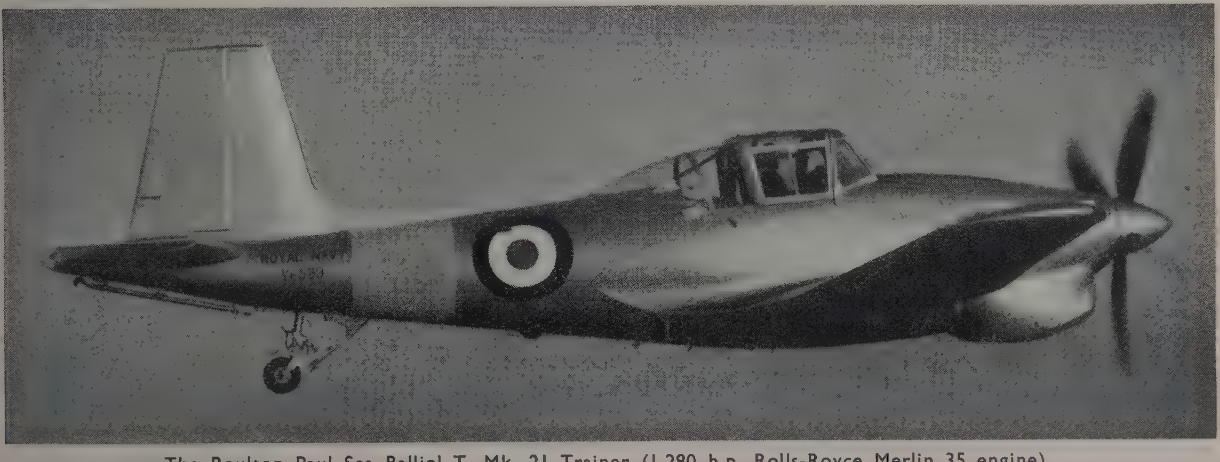
TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering of movable surfaces. The two halves of the tailplane and the fin are identical and interchangeable, as are the port and starboard elevators. Horizontal tail area 51.4 sq. ft. (4.78 m.²). Vertical tail area 25.3 sq. ft. (2.35 m.²).

LANDING GEAR.—Main wheels retractable. Pneumatic retraction. Cantilever oleo-pneumatic legs are interchangeable from port to starboard. Shock absorbing and damping characteristics are suitable for deck landings. Non-retractable tail-wheel is steerable, but steering connection can be disengaged at will from the cockpit, when the tail-wheel becomes fully castoring and self-centering. It can also be locked in the fore-and-aft position for the take-off. Track 15 ft. (4.57 m.).

POWER PLANT.—One Rolls-Royce Merlin 35 twelve-cylinder Vee liquid-cooled engine rated at 1,245 h.p. at 11,500 ft. (3,510 m.) combat rating, 1,060 h.p. at 9,250 ft. (2,280 m.) for continuous cruising, and with 1,280 h.p. available for take-off. de Havilland four-blade constant-speed airscrew, 11 ft. 3 in. (3.43 m.) diameter. One fuel tank in fuselage and one in each wing. total capacity 125 Imp. gallons (570 litres). One drop tank may be attached beneath each wing.

ACCOMMODATION.—Side-by-side seating for instructor and pupil with full dual control. Electically-operated sliding hood. Cockpit heating and ventilation. Alternative equipment covers the full range of requirements for advanced training in flying, navigation, gunnery, bombing, photography and glider towing.

DIMENSIONS.—
Span 39 ft. 4 in. (12 m.).

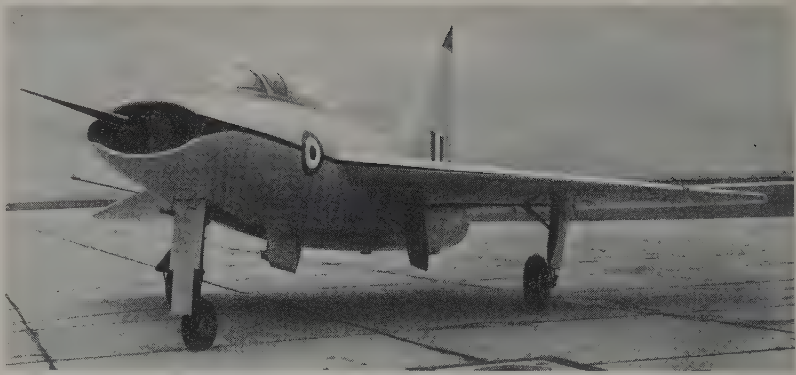


The Boulton Paul Sea Balliol T. Mk. 21 Trainer (1,280 h.p. Rolls-Royce Merlin 35 engine).

Width (wings folded) 21 ft. 8 in. (6.6 m.).
Length 35 ft. 1½ in. (10.7 m.).
Height (over airscrew, tail down) 12 ft. 6 in. (3.8 m.).

WEIGHTS AND LOADINGS.—
Weight empty (with 884 lb.=402 kg. fixed equipment) 6,730 lb. (3,053 kg.).
Removable equipment 263 lb. (120 kg.).
Fuel and oil 968 lb. (439 kg.).
Crew (2) including parachutes, cushions and dinghies 448 lb. (204 kg.).
Weight loaded 8,410 lb. (3,817 kg.).
Wing loading 33.64 lb./sq. ft. (164.5 kg./m.^{2}).
Power loading 6.57 lb./h.p. (2.95 kg./h.p.).

PERFORMANCE.—
Max. speed at 9,000 ft. (2,740 m.) 288 m.p.h. (465 km.h.).
Max. continuous cruising speed (rich mixture) at 8,000 ft. (2,440 m.) 266 m.p.h. (430 km.h.).
Max. continuous cruising speed (weak mixture) at 5,500 ft. (1,675 m.) 231 m.p.h. (372 km.h.).
Stalling speed 83 m.p.h. (134 km.h.).
Time to 15,000 ft. (4,575 m.) 10 mins.
Service ceiling 32,500 ft. (9,910 m.).
Take-off distance to 50 ft. (15.25 m.) 450 yds. (412 m.).
Landing distance from 50 ft. (15.25 m.) 650 yds. (595 m.).
Endurance at 222 m.p.h. (357 km.h.) at 10,000 ft. (3,050 m.) 3 hours.



The Boulton Paul P.111A Delta-wing Research Monoplane.

THE BOULTON PAUL P.111.

The P.111 is a single-seat high-speed research aeroplane with the delta wing plan-form. The wing is mounted in the mid position, and houses the inwards retracting main landing-gear units and the fuel tanks. Control is effected through elevons in the wing and a rudder.

Power is provided by a single Rolls-Royce Nene turbojet engine in the fuselage. A parachute is carried in a fairing on the port side of the rear fuselage and can be used to reduce landing speed and landing run.

First flight of the P.111 was made at Boscombe Down on October 10, 1950.

The P.111A, which is the P.111 with fuselage air brakes and other slight modifications, was flown for the first time on July 2, 1953.

DIMENSIONS.—
Span 33 ft. 5½ in. (10.21 m.).
Length 26 ft. 1 in. (7.95 m.).
Height over fin 12 ft. 6½ in. (3.82 m.).
Wheel track 14 ft. 5 in. (4.4 m.).

WEIGHTS AND PERFORMANCE.—
No data available.

BRISTOL

THE BRISTOL AEROPLANE CO., LTD.

HEAD OFFICE, WORKS AND AERODROME: FILTON, BRISTOL.

LONDON OFFICE: 6, ARLINGTON STREET, ST. JAMES'S, S.W.1.

Established: 1910.

Directors: Sir Reginald Verdon Smith, M.A., B.C.L., J.P. (Chairman and Joint Managing Director); Sir G. Stanley White, Bt. (Deputy Chairman); G. S. M. White (Joint Managing Director); Sir William G. Verdon Smith, C.B.E., J.P.; Sir Alec Coryton, K.C.B., K.B.E., M.V.O., D.F.C. (Divisional Managing Director, Engine Division); F. R. Banks, C.B., O.B.E., F.R.Ae.S., M.I.Mech.E.; K. J. G. Bartlett, C.B.E., A.F.R.Ae.S., M.Inst.T., M.S.A.E.; C. F. Uwins, O.B.E., A.F.C. F.R.Ae.S. (Divisional Managing Director, Aircraft Division); Brian Davidson, M.A. (Commercial Director); Dr. A. E. Russell, C.B.E., D.Sc., F.R.Ae.S., F.I. Ae.S. (Technical Director, Aircraft Division); Dr. S. G. Hooker, O.B.E., D.Phil., D.I.C., F.R.Ae.S. (Chief Engineer, Engine Division); and W. Masterton, C.A. (Financial Director).

General Manager (Aircraft Division): R. S. Brown, M.I.P.E.

Chief Designer (Fixed-wing Aircraft): Dr. W. J. Strang.

Chief Designer (Rotary-wing Aircraft): Raoul Hafuer.

Chief Designer (Guided Missiles): D. J. Farrar.

Chief Development Engineer (Aircraft Division); H. J. Pollard, F.R.Ae.S.

Chief Test Pilot: A. J. Pegg, M.B.E.

Divisional Secretary (Aircraft Division): G. E. Knight.

Founded in 1910 by the late Sir George White, Bt., this company was originally known as The British and Colonial Aeroplane Company Ltd.

Now in production are the Bristol Type 175 Britannia medium/long-range airliner, on order for B.O.A.C. and other operators, the Type 170 Freighter civil and military transport, in service throughout the World, the Type 171 helicopter, and the twin-engined/twin-rotored Type 173 helicopter.

B.O.A.C. has ordered fifteen Britannia Mk. 100's, eight Mk. 200's and ten Mk. 300 L.R.'s, while the Ministry of Supply has on order three Britannia Mk. 250 L.R.'s. El Al (Israel Airlines) has ordered three Britannia Mk. 300 L.R.'s and has an option for a further two. In order to meet production requirements, a second production line has been set up at Belfast by Short Brothers & Harland, Ltd.

Canadair, Ltd. of Montreal, P.Q. is building a long-range maritime reconnaissance version of the Britannia for the Royal Canadian Air Force. Details of this specialised version, which will be powered by four piston engines, will be found under "Canadair."

In 1954 the Bristol Company received an order for about one hundred twin-engined twin-rotor helicopters, based on the design of the Type 173, for the Royal Navy and the Royal Air Force.

The company is also engaged on development of guided weapons and their power units.

Details of the activities of the Aero-Engine Division of the Bristol Aeroplane Co., Ltd. will be found in the Aero-Engine Section.

THE BRISTOL TYPE 175 BRITANNIA.

A fleet of 33 Britannias are being built for B.O.A.C. and are due to enter service in 1956. The Britannia is a considerable advance on the initial Medium-Range Empire transport proposed by B.O.A.C. in 1947. All the aircraft at present under construction will have four Bristol Proteus turboprop engines. A later stage in Britannia development will be the installation of the Bristol BE 25 constant-power turboprop engine which is being developed under a Ministry of Supply contract.

The first production version of the Britannia, the Mk. 100, will have a basic

The first production Bristol Britannia Mk. 100 Airliner (four 3,780 h.p. Bristol Proteus 705 turboprop engines).

interior layout permitting ready conversion from first class accommodation for some 60 passengers to a "tourist" version carrying 93 passengers, or *vice versa*.

The first prototype of the Britannia flew for the first time on August 16, 1952, and the first production Britannia 100 (G-ANBA) made its maiden flight on September 15, 1954.

Further versions announced are the Mk. 250 (mixed freight and passenger version), the Mk. 300 (passenger airliner), and long-range versions of both these aircraft. All are larger and more powerful developments of the Mk. 100. Each will have a fuselage 10 ft. 3 in. (3.12 m.) longer than that of the Mk. 100, and the gross weight will be increased from 150,000 lb. (68,100 kg.) to 155,000 lb. (70,370 kg.). All are powered by four Proteus 755 engines, each of 4,120 equivalent shaft horse-power. These versions will be available for delivery in 1956-57.

Type.—Four-engined Airliner.

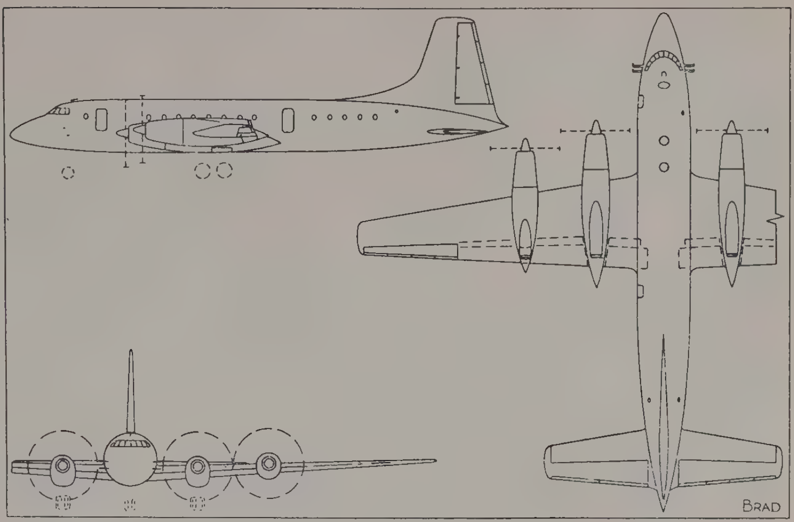
Wings.—Low-wing cantilever monoplane. Wing section NACA 25017 at root, tapering to NACA 4413 modified at tip. Aspect ratio 9.76. Dihedral constant from roots, 3°. Incidence 3° at root, 0.6° at tip. Root chord 22 ft. 7¼ in. (6.88 m.). Aluminium-alloy box-spar stressed skin structure. Servo-tab-operated ailerons in outer wings and double-slotted trailing-edge flaps each side on inner wing. Thermal anti-icing. Total area of ailerons 70 sq. ft. (6.52 m.²). Total area of flaps 410 sq. ft. (38.1 m.²). Gross wing area 2,075 sq. ft. (192.7 m.²).

Fuselage.—Aluminium-alloy monocoque structure pressurised to 8.25 lb./sq. in. Maximum diameter 12 ft. (3.66 m.).

Tail Unit.—Cantilever metal tailplane and single fin and rudder. Aluminium-alloy box-spar structure. Servo tabs in all control surfaces. Areas: fin 264.2 sq. ft. (24.5 m.²), rudder 92.2 sq. ft. (8.56 m.²), tailplane 418 sq. ft. (38.8 m.²), elevators 170 sq. ft. (15.6 m.²). Tailplane span 55 ft. (16.7 m.).

Landing Gear.—British Messier retractable nose-wheel type. Main units beneath inner nacelles each have a four-wheel bogie. Nose unit has twin wheels. Hydraulic retraction. Dunlop wheels and Dunlop Maxaret hydraulic brakes. Wheel track (bogie centres) 31 ft. 0 in. (9.45 m.). Wheelbase 35 ft. 3.4 in. (10.80 m.).

Power Plant.—Four 3,780 e.h.p. Bristol Proteus 705 (Mark 100) or 4,120 e.h.p. Proteus 755 (Marks 200, 250 and 300) turboprop engines driving de Havilland hydromatic four-blade airscrews. Main fuel tankage in wing-spar box. Total internal fuel capacity (Mks. 100, 250 and 300) 6,772 Imp. gallons (30,745 litres).



The Bristol 175 Britannia Mk. 100 Airliner.

Total internal fuel capacity (Mk. 300 LR) 8,486 Imp. gallons (38,526 litres). Total oil capacity (all marks) 44 Imp. gallons (200 litres).

Accommodation (Mk. 100).—Crew of 8 and up to 90 passengers in pressurized cabins. Main passenger accommodation in two cabins, in centre fuselage and rear fuselage, with main entrance (port side) between. Additional entrance and pantry forward. Baggage compartment immediately aft of flight deck. Freight holds below cabin floor.

Accommodation (Mk. 250).—For 87 passengers. Also 10,000 lb. (4,540 kg.) of freight on main deck, in addition to main freight holds.

Accommodation (Mk. 300). Crew of 9 and 99 passengers.

Dimensions (Mk. 100).—
- Span 142 ft. 3½ in. (43.38 m.).
- Length 114 ft. (34.77 m.).
- Height 36 ft. 8.3 in. (11.19 m.).

Dimensions (Mks. 250 and 300).—
- Span 142 ft. 3½ in. (43.38 m.).
- Length 124 ft. 3 in. (37.89 m.).
- Height 36 ft. 8.3 in. (11.19 m.).

Weights (Mk. 100).—
- Weight empty 81,100 lb. (36,820 kg.).
- Max. payload 25,000 lb. (11,350 kg.).
- Max. all-up weight 150,000 lb. (68,100 kg.).
- Max. landing weight 115,000 lb. (52,210 kg.).

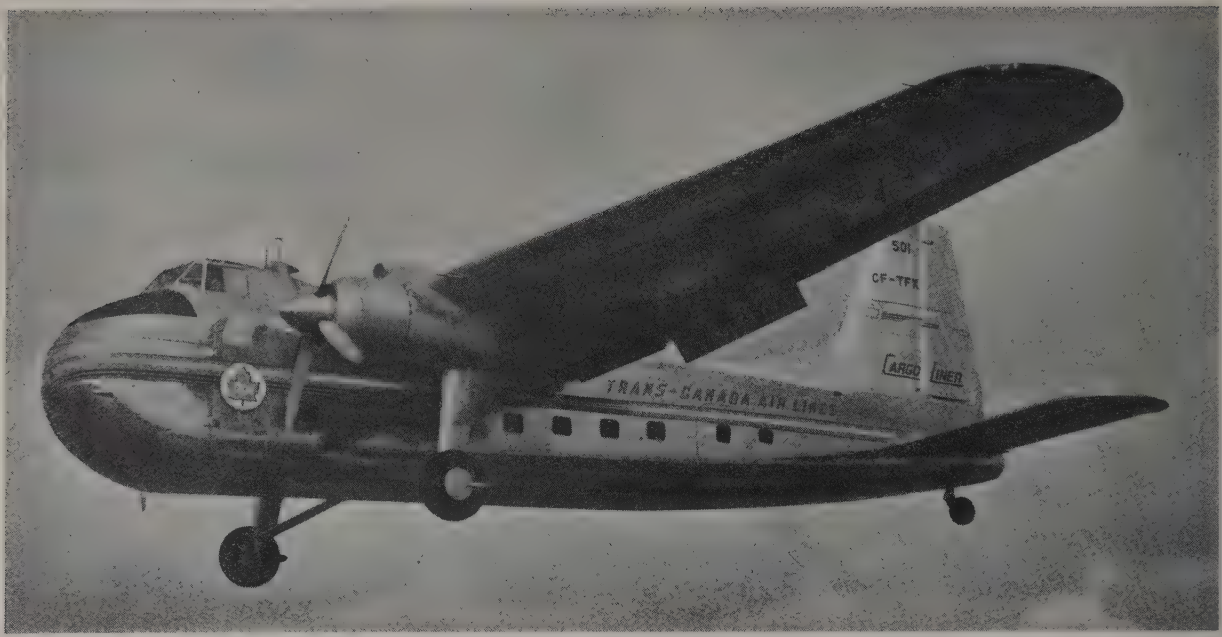
Weights (Mk. 300).—
- Weight empty 85,000 lb. (38,590 kg.).
- Max. payload 30,000 lb. (13,620 kg.).
- Max. all-up weight 155,000 lb. (70,370 kg.).
- Max. landing weight 125,000 lb. (56,750 kg.).

Weights (Mk. 300 LR).—
- Weight empty 83,250 lb. (37,795 kg.).
- Max. payload 28,000 lb. (12,712 kg.).
- Max. all-up weight 170,000 lb. (77,180 kg.).
- Max. landing weight 127,000 lb. (57,660 kg.).

Performance (Mk. 100).—
- Normal cruising speed 375 m.p.h. (610 km.h.).
- Long-range cruising speed 345 m.p.h. (552 km.h.).
- Still-air range with max. payload (25,000 lb.=11,350 kg.) 3,920 miles (6,270 km.) at 375 m.p.h. (610 km.).
- Still-air range with 14,000 lb. (6,356 kg.) payload 5,300 miles (8,480 km.) at 375 m.p.h. (610 km.h.).
- Take-off distance to 50 ft. (15.25 m.) at S/L, no wind at max. A.U.W. 5,050 ft. (1,540 m.).
- Landing distance from 50 ft. (15.25 m.) at S/L, no wind 3,040 ft. (930 m.).

Performance (Mk. 300).
- Normal cruising speed 385 m.p.h. (616 km.h.).
- Long-range cruising speed 350 m.p.h. (560 km.h.).
- Still-air range with max. payload (30,000 lb.=13,620 kg.) 3,450 miles (5,502 km. at 385 m.p.h. (616 km.h.).
- Still-air range with 11,000 lb. (4,994 kg.) payload 5,590 miles at 385 m.p.h. (616 km.h.).

The first production Bristol Britannia Mk. 100 Airliner (four 3,780 h.p. Bristol Proteus 705 turboprop engines).



The Bristol Type 170 Mk. 31 Freighter (two 1,980 h.p. Bristol Hercules 734 engines).

Take-off distance to 50 ft. (15.25 m.) at S/L, no wind at max. A.U.W. 4,590 ft. (1,400 m.).
Landing distance from 50 ft. (15.25 m.) at S/L, no wind 3,025 ft. (923 m.).

PERFORMANCE (Mk. 300 LR).—
Cruising speed as for Mk. 300.
Still-air range with 28,000 lb. (12,712 kg.) payload 4,600 miles (7,360 km.).
Still-air range with 25,000 lb. (11,350 kg.) payload 5,300 miles (8,480 km.).
Still-air range with 17,000 lb. (7,720 kg.) payload 6,210 miles (10,000 km.).
Take-off distance to 50 ft. (15.25 m.) at S/L, no wind at max. A.U.W. 6,250 ft. (1,906 m.).
Landing distance from 50 ft. (15.25 m.) same as for Mk. 300.

THE BRISTOL TYPE 170.

Originally designed as a freight or passenger aircraft capable of transporting a large payload over comparatively short distances, the Type 170 has been developed to give extended range and to carry a greater payload. The standard version, known as the Mk. 31, has a British C. of A. in Category A for a maximum take-off weight of 44,000 lb. (19,958 kg.).

The current versions of the Type 170 are :—

Mark 31. Freighter version. Nose opening doors as on earlier marks and 2,300 cub. ft. (65.2 m.^{3}) of hold and lobby space available for cargo. Normally the Freighter version is provided with soundproofing in pilot's compartment only. Ventilation and heating can be supplied for the hold as well as the cockpit.

Mark 31E. Passenger or mixed traffic version. Differs from Freighter by the normal installation of full sound-proofing, heating and ventilation and provision of seat attachments in floor of hold. Maximum number of seats which can be fitted is 56, with fuel for a still air stage length of 540 miles (870 km.). Normally, seating for 44 is supplied, which permits fuel to be carried for 1,030 miles (1,658 km.). A movable bulkhead enables the hold to be adapted for mixed passenger and freight use or, by complete removal of bulkhead and all seats, for freight only.

Mark 32. Version with lengthened fuselage forward of wings, nine of which have been supplied to Silver City Airways and two to Air Charter, Ltd. Fuselage length increased to 73 ft. 8 in. (22.47 m.), the additional 5 ft. 4 in. (1.60 m.) being added forward of the wings. Car hold increased in length from 31 ft. 8 in. (9.65 m.) to 37 ft. 11 in. (11.56 m.) and capable of extension to 43 ft. 3 in. (13.11 m.) by movable partition to enable aircraft to carry three cars of 14 ft. (4.27 m.) length or two of the largest American automobiles. Accommodation for passengers behind car hold increased from 15 to 23. Additional windows fore and aft, sound-proofing, luggage racks, etc. Fin area increased by 10 sq. ft. (0.93 m.^{2}) by extension to top of main fin and larger dorsal fin. Performance same as for standard Mk. 31. First Mk. 32 flew for the first time on January 16, 1953.

Apart from the large number of civil versions which have been supplied for use in all parts of the World for a wide variety of duties, the Type 170 has also been produced as a military aircraft and is in service in the Royal Australian Air Force, Royal Canadian Air Force, Royal New Zealand Air Force, Royal Pakistan Air Force, Royal Iraqi Air Force and the Burma Air Force.

The 200th Freighter, a Mk. 32, was delivered to Air Charter, Ltd. on March 25, 1955.

TYPE.—Twin-engined Passenger or Freight Transport.

WINGS.—Cantilever high-wing monoplane. Aerofoil section R.A.F. 28 (modified) with thickness/chord ratio of 17.5% at root, decreasing to 15% at tip. All-metal two-spar structure. All-metal constant-chord Frise ailerons with fabric covering and

The Bristol Type 170 Mk. 32 Freighter, the long-nosed version in service with Silver City Airways.

controllable trim-tab in each. Aileron area (each) 39.2 sq. ft. (3.64 m.²). Pneumatically-operated all-metal split trailing-edge flaps in two sections each side between ailerons and fuselage. Total flap area 82.7 sq. ft. (7.68 m.²). Gross wing area 1,487 sq. ft. (138 m.²).

FUSELAGE.—All-metal structure in two main sections. Nose-section is split on vertical centre-line and hinged to open for loading.

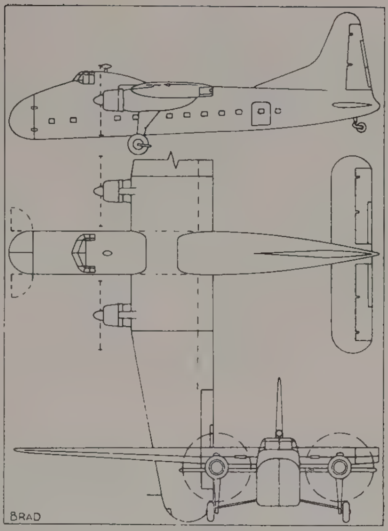
TAIL UNIT.—All-metal cantilever monoplane type. Rudder and elevators have metal frames and fabric covering. Rudder fitted with controllable spring and trim-tabs, and elevators with spring-tab in port and trim-tab in starboard. Tailplane area 307 sq. ft. (28.5 m.²). Elevator area (each) 34.2 sq. ft. (3.17 m.²). Fin (including dorsal fin) area 164.6 sq. ft. (15.29 m.²). Rudder area aft of hinge line 36.3 sq. ft. (3.37 m.²). Tailplane span 40 ft. (12.192 m.).

LANDING GEAR.—Fixed tail-wheel type. Dowty liquid-spring shock-absorbers. Dunlop pneumatic brakes. Castoring tail-wheel on Dowty liquid-spring shock-absorber unit. Track 27 ft. 4 in. (8.54 m.). Wheel base (tail down) 46 ft. 5⅝ in. (14.17 m.).

POWER PLANT.—Two 1,980 h.p. Bristol Hercules 734 fourteen-cylinder two-row radial sleeve-valve air-cooled engines. de Havilland four-blade constant-speed full-feathering metal airscrews, 14 ft. (4.27 m.) diameter. Two 350 Imp. gallon (1,592 litre) alloy fuel tanks in centre-section, one on each side of fuselage. Two tanks in each outer wing 135 Imp. gallons (616 litres) and 100 Imp. gallons (455 litres). Oil capacity 44 Imp. gallons (200 litres).

ACCOMMODATION (Mk. 31).—Crew of three in flight compartment, reached via hatch in floor and ladder on starboard wall of main freight hold. Pilot (on port) and co-pilot seated side-by-side with dual controls and radio operator aft of the co-pilot. Main cargo hold is 31 ft. 8 in. long × 6 ft. 8 in. high (9.65 m. × 2.03 m.) with volume of 2,300 cub. ft. (57.2 m.³). Tying-down points in floor. Mechanically-operated twin nose doors permit direct loading of freight and allow vehicles to be driven in via a ramp. At rear of main hold is smaller freight compartment 8 ft. 4 in. long × 8 ft. wide × 6 ft. 8 in. high (2.54 m. × 2.44 m. × 2.03 m.) with volume of 240 cub. ft. (9.6 m.³) and with door 6 ft. 4 in. high × 6 ft. wide (1.83 m. × 1.8 m.) in bulkhead. External door on port side of fuselage 4 ft. 10 in. high × 4 ft. wide (1.47 × 1.22 m.) for loading rear compartment.

ACCOMMODATION (Mk. 31E).—Passenger or mixed traffic version. Differs from Mk. 31 by normal installation of full sound-proofing, heating and ventilation and provision of seat, attachment strips pierced at 4 in. (101.6 cm.) intervals to permit wide variety of seating arrangements. Normal seating for 44 passengers (1,030 miles = 1,658 km. range). Movable bulk-head permits various arrangements of mixed passenger/cargo accommodation and by complete removal of bulkhead hold may be used entirely for cargo. Passenger entry in lobby aft of main hold. Steward's pantry can be fitted in lobby. Passenger's baggage room aft of lobby.



The Bristol Type 170 Mk. 32.

EQUIPMENT.—24-volt electric system. T.K.S. de-icing system. Janitrol 100,000 BThU cabin heaters.

DIMENSIONS.—
Span 108 ft. (32.93 m.).
Length 68 ft. 4 in. (20.80 m.).
Length (Mk. 32) 73 ft. 8 in. (22.47 m.).
Height over fin (rigging position) 26 ft. 3½ in. (8.0 m.).

WEIGHTS AND LOADINGS (Mk. 31 cargo).—
Weight empty 27,229 lb. (12,334 kg.).
Crew (2) 330 lb. (149 kg.).
Oil 396 lb. (180 kg.).
Payload plus fuel 16,045 lb. (7,268 kg.).
Weight loaded 44,000 lb. (19,958 kg.).
Wing loading 29.6 lb./sq. ft. (144.5 kg./m.²).
Power loading 11.0 lb./h.p. (5.0 kg./h.p.).

WEIGHTS AND LOADINGS (Mk. 31E cargo/passenger).—
Weight empty 28,465 lb. (12,894 kg.).
Crew (2) 330 lb. (149 kg.).
Oil 396 lb. (180 kg.).
Payload plus fuel 14,909 lb. (6,708 kg.).
Weight loaded 44,000 lb. (19,958 kg.).
Loadings as above.

WEIGHTS AND LOADINGS (Mk. 31E passenger).—
Weight empty 29,501 lb. (13,363 kg.).
Crew (3) 450 lb. (203 kg.).
Oil 396 lb. (180 kg.).
Payload plus fuel 13,653 lb. (6,184 kg.).
Weight loaded 44,000 lb. (19.958 kg.).
Loadings as above.

WEIGHTS AND LOADINGS (Mk. 32 cargo passenger).—
Weight empty 29,554 lb. (13,397 kg.).
Crew (3) 510 lb. (232 kg.).
Oil 396 lb. (180 kg.).
Payload plus fuel 13,653 lb. (6,184 kg.).
Weight loaded 4.400 lb. (19.958 kg.).
Loading as above.

PERFORMANCE (all Marks).—
Max. speed 225 m.p.h. (362 km.h.) at 3,000 ft. (914 m.).
Recommended cruising speed (950 h.p. per engine) 164 m.p.h. (264 km.h.) at 5,000 ft. (1,525 m.).
Climb to 10,000 ft. (3,050 m.) at max. continuous power 10.0 minutes.
Rate of climb on one engine at full loaded weight 240 ft./min. (73 m./min.).
Service ceiling (at 38,000 lb. = 17,236 kg. loaded weight and max. continuous power) 23,000 ft. (7,010 m.).
Single engine ceiling (at 38,000 lb. = 17,236 kg. loaded weight and emergency climb power) 12,900 ft. (3,477 m.).
Take-off distance to 50 ft. (15.25 m.) 5 m.p.h. wind 2,500 ft. (762 m.).
Landing distance from 50 ft. (5 m.p.h. wind) (15.25 m.) 2,300 ft. (701 m.).
Range (in still air) 12,000 lb. (5,443 kg.) payload 820 miles (1,320 km.).

THE BRISTOL TYPE 173 HELICOPTER.

The Bristol Type 173 was the company's second helicopter design and the first British multi-engined helicopter. The first prototype flew for the first time on January 3, 1952.

The Type 173 uses two similar rotors, one at each end of the fuselage and each driven by its own engine. The rotors and rotor heads are, in fact, essentially similar to those of the Type 171.

In 1953 the first prototype successfully made a series of trials at sea on board H.M. aircraft-carrier *Eagle*.

A second prototype was for a time fitted experimentally with auxiliary wings to explore their effect on forward flight performance.

Both the first and second prototype 173's are powered by two 500-520 h.p. Alvis Leonides engines.

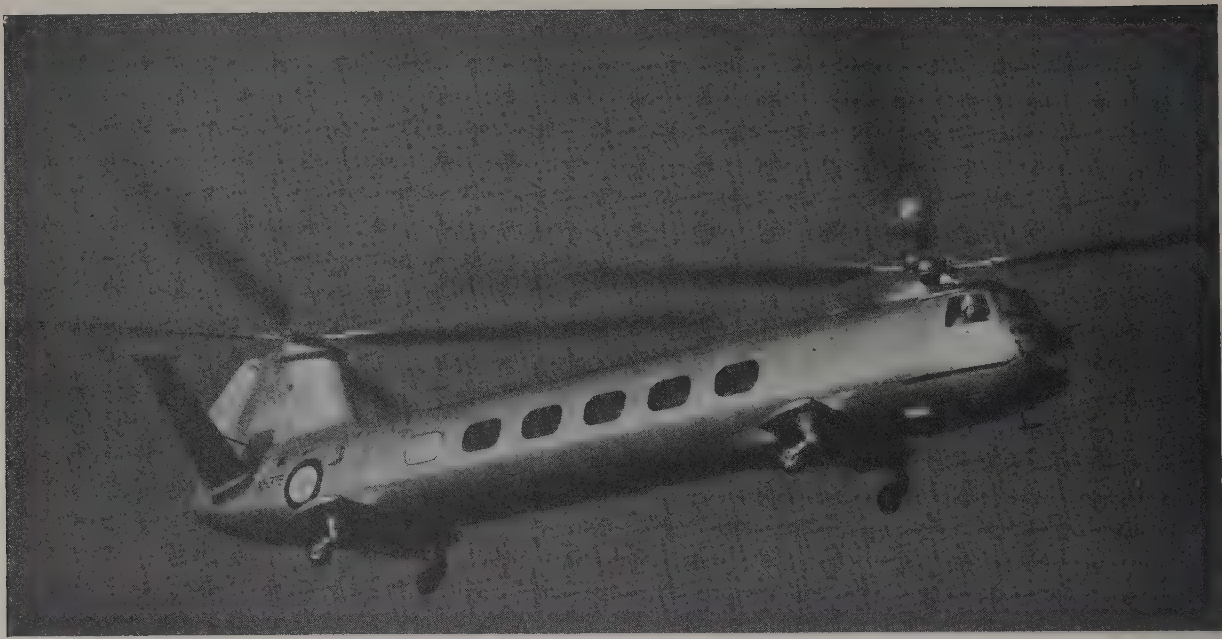
The Mk. 3 version will be powered by two 850 h.p. Alvis Leonides Major engines and will be used for research and development.

The description which follows refers to the Mk. 3 prototype version.

TYPE.—Research and Development Helicopter.

ROTOR SYSTEM.—Two four-blade rotors, one on top of forward fuselage, other carried on rear pylon. Rotor blades in

The first prototype Bristol Type 173 Helicopter is here seen during its sea-going trials in H.M.S. *Eagle*.



The prototype of the Bristol Type 173 Mk. 3 Helicopter (two 850 h.p. Alvis Leonides Major engines).

prototype are of wooden construction; production aircraft will have metal rotors. Basic blade section NACA 006-0015 Total disc area 3,720 sq. ft. (34.75 m.^{2}).

Rotor Drive.—Each rotor driven by shaft from engine immediately beneath. Rotors are linked by a synchronisation shaft to ensure running at same speed and in correct phase, and to permit one engine to drive both rotors in case of one engine failing. A free wheel and clutch in the drive shaft between each engine and its rotor makes it possible to isolate a dead engine, and provides for full autorotation.

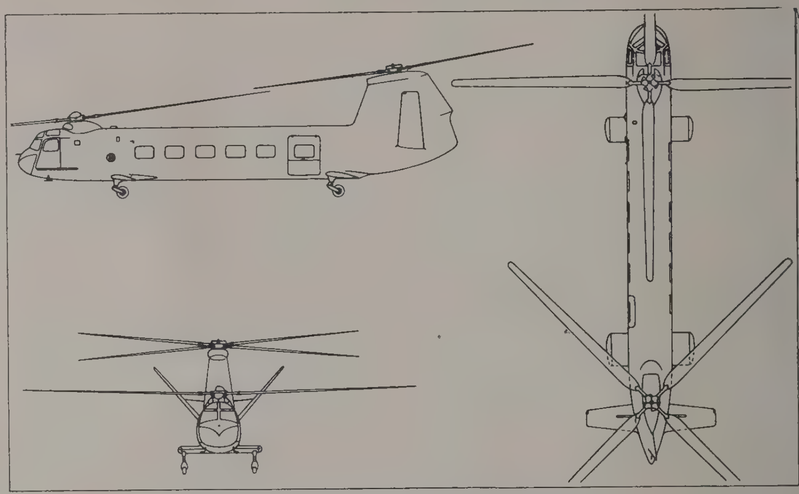
Fuselage.—Metal monocoque structure. Front section contains flight deck and is largely panelled with Perspex; next is front engine bay, including fuel and oil and drive to front rotor; then main passenger cabin; and finally, the rear engine bay, together with rear fuel tank, rear rotor pylon and tailplane.

Landing Gear.—Four-wheel fixed type. Track 8 ft. 6 in. (2.59 m.). Wheelbase 28 ft. 8 in. (8.76 m.).

Power Plant.—Two 850 h.p. Alvis Major fourteen-cylinder radial air-cooled engines mounted with crankshafts vertical. Each engine in steel cowling forming a fireproof box and separate from cabin and pilot's cockpit by soundproof bulkheads.

Accommodation.—Crew of two in forward compartment. Provision for dual control. Crew access doors on each side of nose. Main passenger cabin between two engine bays, 28 ft. 9 in. (8.77 m.) long, 5 ft. 3 in. (1.60 m.) wide and 5 ft. 3 in. (1.60 m.) high plus $5\frac{1}{2}$ in. (14 cm.) for aisle recess. Five individual seats down each side of central sunken aisle, with curved settee for three at rear on starboard opposite main access door in port side. Cabin 26 ft. 2 in. (7.9 m.) × 5 ft. 3 in. (1.60 m.) × 5 ft. 3 in. (1.60 m.) plus $5\frac{1}{2}$ in. (14 cm.) for aisle recess. Six windows each side are jettisonable for emergency exit. Cabin provides 700 cub. ft. (19.83 m.^{3}) of constant section stowage.

Controls.—Collective pitch on both rotors operated conjointly by single collective pitch lever in cockpit. Fore and aft control is obtained through control column, by altering differentially the collective pitch of rotors in conjunction with simultaneous cyclic pitch changes. Lateral control is by simultaneous change of cyclic pitch and tilting rotor discs laterally. Directional control is by rudder pedals, which produce differential cyclic pitch change and tilt the rotors laterally in opposite directions. Pitching and yawing stability in forward flight provided by a fixed, dihedral tailplane braced to the fuselage. Tailplane area 48 sq. ft. (4.49 m.^{2}).



The Bristol Type 173 Mk. 3 Helicopter.

Dimensions.

- Rotor diameter, each 48 ft. 6.7 in. (14.80 m.).
- Rotor centres 41 ft. $1\frac{1}{4}$ in. (12.53 m.).
- Overall length (rotors folded) 54 ft. $1\frac{3}{4}$ in. (16.51 m.).
- Overall width (rotors folded) 18 ft. 0 in. (6.48 m.).
- Overall height (rotors folded) 16 ft. $6\frac{1}{4}$ in. (5.03 m.).
- Height to front hub centre 9 ft. $9\frac{1}{4}$ in. (2.97 m.).
- Height to rear hub centre 16 ft. $6\frac{1}{4}$ in. (5.03 m.).

Weights and Loadings.—

- Weight empty 9,839 lb. (4,465 kg.).
- Crew (two) 340 lb. (154 kg.).
- Fuel and payload 2,572 lb. (1,168 kg.).
- Oil 144 lb. (65 kg.).
- Max. all-up weight 13,500 lb. (6,125 kg.).
- Disc loading 3.63 lb./sq. ft. (17.65 kg./m.^{2}).
- Power loading 7.9 lb./h.p. (3.58 kg./h.p.).

Performance.—

No data available.

The Bristol Type 171 Mk. 3A Helicopter (Alvis Leonides engine).

THE BRISTOL TYPE 171 HELICOPTER.

British Military Name: Sycamore.

The Type 171, which first flew in 1947, was the first rotating wing aircraft to be built by the Bristol company. In service as a civil transport and in a number of military and naval rôles, the Type 171 provides accommodation for five persons, including one or two pilots. The standard power-unit is the Alvis Leonides Mk. 73 engine.

The current versions are :—

Type 171 Mk. 3A. Specially modified version built for B.E.A. passenger services. Incorporates side exhaust, revised instrument panel layout, Decca navigational aids and a re-designed fuselage giving

greater luggage space behind engine. Accommodation for four passengers.

Type 171 Mk. 4. Current production version for casualty evacuation and search and rescue, but capable of rapid conversion for passenger and freight transport. The change-over from one version to another can be made rapidly.

The following military models have also been produced :—

Sycamore H.C. Mk. 10. Primarily an ambulance with accommodation for two standard stretchers carried athwartships at back of cabin, one above the other. Ends of stretchers accommodated by Perspex blisters, one on each side of cabin. Swivel seat for medical attendant.

Sycamore H.C. Mk. 11. Communications, observation and transport version in service with British Army. Standard R.A.F. and Army radio. Ropé ladder for use over unsuitable landing terrain. Strong points under fuselage for carrying loads up to 1,600 lb. (726 kg.).

Sycamore H.R. Mk. 12. Search and rescue or communications aircraft in service with R.A.F. Coastal Command.

Sycamore H.R. Mk. 13. Search and rescue or communications aircraft in service with R.A.F. Fighter Command.

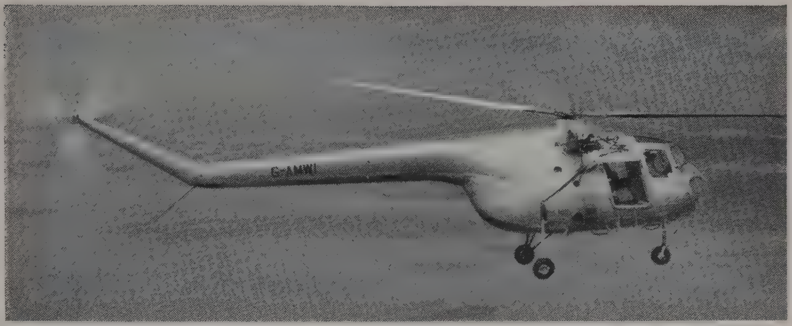
Sycamore H.R. Mk. 14. Search and rescue, ambulance or communications aircraft for service with the R.A.F.

Sycamore H.R. Mk. 50 and 51. Search and rescue or communications aircraft in service with the Royal Australian Navy. Similar to Mks. 13 and 14 respectively. Hydraulically operated winch on starboard side of fuselage. Seats of folding "deck chair" type, to give increased working space for winch operation and rescue work. Open starboard doorway covered by quick-release curtain for rescue missions. In communications rôle winch is removed and starboard door aperture covered by metal panel containing a knock-out Perspex escape hatch. Side exhaust to avoid burning or scorching when landing in scrub or on ship's deck. Modified instrument panel layout. The Mk. 50 was the first version to embody the new landing-gear, now standard in production aircraft, which gives an additional 9 inches ground clearance and raises height of rotor disc during ground running.

The description below refers primarily to the Mk. 4 version which is now in production.

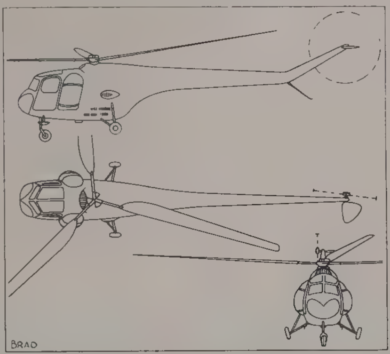
TYPE.—Four or Five-seat Civil or Military Helicopter.

ROTOR SYSTEM.—Three-blade main rotor and three-blade anti-torque rotor. Blades, of Bristol design, of wooden construction with Hydulignum spar along leading-edge, spruce and ply ribs and plywood covering. Two sheet metal tabs, one in vicinity of blade tip and the other near root, correct aerodynamic balance. Blades fully articulated in both flapping and drag planes. Adjustable friction dampers on drag hinges, and spacer rods with rubber buffers between blades. The blades are mounted on tie rods which take the centrifugal force directly in tension but are flexible in torsion. Main portion of blade attached to metal root by series of plates interleaved with spar laminations at one end and a pick-up with two bolts in metal root portion at other. By removing one bolt from each blade it can be folded back and locked for parking purposes. All-metal blades are now being developed.

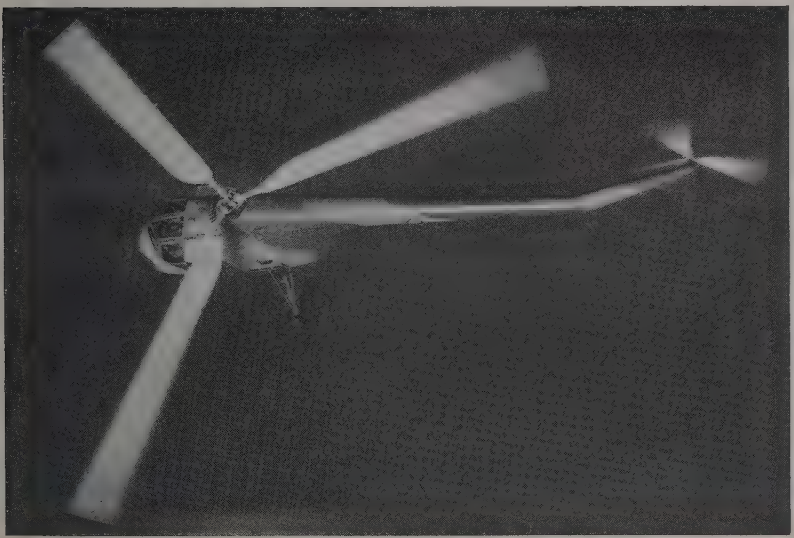


The Bristol Type 171 Mk. 4 Helicopter (Alvis Leonides engine).

ROTOR DRIVE.—Drive from engine taken through centrifugal clutch via a vertical shaft to main gear-box below rotor head, which has a two-stage spur reduction gear. From this main gear-box a further drive is taken to shaft which runs down rear fuselage through constant-velocity Hardy Spicer universal joint to a bevel gear-box and so to tail rotor. Free wheel ensures both main and tail rotors will auto-rotate in event of engine failure. Rotor brake above free wheel. Accessories driven from main rotor gear-box, so that they continue to function in event of engine failure.



The Bristol Sycamore H.C. Mk. 10



The Bristol Type 171 Sycamore H.R. Mk. 14 Helicopter.

FUSELAGE.—In three sections, nose, centre and rear. Nose section is metal monocoque with Perspex and metal fairing. Centre-section has welded steel-tube frames with metal skin. Rear section is a metal monocoque.

LANDING GEAR.—Fixed tricycle type with castoring nose-wheel. Pneumatic shock-absorbers to all three wheels. Tail skid aft to prevent damage to tail rotor. Wheel track 9 ft. (2.74 m.).

POWER PLANT.—One 500/520 h.p. Alvis Leonides Mk. 73 nine-cylinder radial air-cooled engine mounted with crankshaft vertical in fuselage centre-section. Engine-driven cooling fan draws air through intake above cabin. Air is ducted from fan past fully-cowled and baffled engine and exhausted through grille at bottom of fuselage centre-section. Steel cowling above cylinders and steel bulkheads below, enclose engine in fireproof box. Graviner spray-ring fire-extinguisher system controllable by pilot. Bag-type fuel cell behind rear engine bulkhead in intermediate fuselage. Normal fuel capacity 65 Imp. gallons (295 litres) ; with auxiliary tank, 89 Imp. gallons (404 litres). Oil tank above engine on rear engine bulkhead in fuselage centre-section. Total oil capacity 6.5 Imp. gallons (29.5 litres).

ACCOMMODATION.—*Search and Rescue* : crew of two with three rear "deck-chair" type seats for rescued personnel. *Ambulance* : pilot and medical orderly and accommodation for two stretcher cases. *Passenger transport, communications, etc.* : four or five persons including crew.

CONTROLS.—Main flying controls consist of a collective-pitch lever, control stick and foot pedals. The collective-pitch lever on the left of the pilot increases or decreases the pitch of the main rotor blades simultaneously, for vertical motion. The control stick varies the cyclic pitch of the blades to give longitudinal and lateral motion. The foot pedals provide directional control and counteract "yaw" by varying the pitch of the tail rotor blades. In addition to the primary controls, a bias gear, operated by handwheels, relieves the load on the control stick, and assists in the longitudinal and lateral trim. A mechanical linkage is provided between the throttle and the collective pitch lever so that the throttle opening is automatically synchronised with increase or decrease of main rotor blade pitch. Over-ride settings of the throttle can be obtained by means of a twist-grip on the pitch lever. The engine clutch is automatic in operation. Full dual control may be provided, but will not normally be fitted.

DIMENSIONS.—
- Main rotor diameter 48 ft. 6.7 in. (14.8 m.).
- Tail rotor diameter 9 ft. 7.3 in. (2.93 m.).
- Length (rotors at extreme positions) 61 ft. 1¼ in. (18.63 m.).
- Length (main rotor folded, tail rotor at min. position) 46 ft. 2 in. (14.1 m.).
- Height (tail rotor in extreme position) 14 ft. 7 in. (4.49 m.).
- Height (tail rotor in min. position) 12 ft. 2 in. (3.71 m.).

WEIGHTS.—
- Basic weight (general purpose) 4,060 lb. (1,853 kg.).
- Basic weight (ambulance rôle) 4,138 lb. (1,881 kg.).
- Basic weight (search and rescue rôle) 4,150 lb. (1,887 kg.).
- All-up weight 5,400 lb. (2,452 kg.).

PERFORMANCE (at A.U.W.—I.C.A.N. conditions).—
- Max. speed (5 min. rating) (sea level), 127

m.p.h. (204 km.h.) at 287 rotor r.p.m.
Max. speed (1 hr. rating) (at 2,000 ft.= 610 m.) 121 m.p.h. (195 km.h.) at 269 rotor r.p.m.
Max. rich mixture cruising speed (at 2,000 ft.=610 m.) 107 m.p.h. (172 km.h.) at 251 rotor r.p.m.
Max. economical cruising speed (at 2,000 ft. =610 m.) 91 m.p.h. (146 km.h.) at 242 rotor r.p.m.
Max. vertical rate of climb (sea level) 420 ft./min. (128 m./min.).
Max. climb at forward speed (5 min. power, sea level), 1,300 ft./min. at 60 m.p.h. I.A.S. (396 m./min. at 96 km.h.).
Service ceiling 15,500 ft. (4,724 m.).
Hovering ceiling (without ground effect) 4,000 ft. (1,220 m.).
Max. still air range at normal load, 268 miles (430 km.).
Max. still air range with auxiliary tank (total fuel 89 Imp. gal.=404 litres) 368 miles (589 km.).

DE HAVILLAND

THE DE HAVILLAND AIRCRAFT CO LTD.

Administration, Design, Experimental and Engineering Departments, Technical School, Etc.: Hatfield Aerodrome, Herts.

Production Factories: Hawarden Aerodrome, near Chester, Hatfield, Herts., Christchurch, Hants., Portsmouth, Hants., and Stevenage, Herts.

Chairman and Managing Director: W. E. Nixon, F.C.I.S.

Technical Director: Sir Geoffrey de Havilland, C.B.E., A.F.C., R.D.I., F.R.Ae.S., Hon. F.I.A.S.

Vice-Chairman and Deputy Managing Director: Francis E. N. St. Barbe.

Chief Engineer: C. C. Walker, C.B.E., A.M.I.C.E., Hon. F.R.Ae.S., Hon. F.I.A.S.

Design Director: R. E. Bishop, C.B.E., F.R.Ae.S.

Director and Secretary: A. Stewart Kennedy, C.A.

Other Directors: F. T. Hearle, C.B.E., F.R.Ae.S., M.I.P.E., H. Povey, Hon. F.R.Ae.S., A. F. Burke, O.B.E., M.Inst.T., F.R.S.A., C. S. Thom and R. M. Clarkson, O.B.E., B.Sc., A.C.G.I., F.R.Ae.S.

Chief Designer (Hatfield): C. T. Wilkins, O.B.E., F.R.Ae.S.

Chief Designer (Christchurch): W. A. Tamblin, A.F.R.Ae.S., A.M.I.N.A.

Associated Companies:—

The de Havilland Engine Co. Ltd., Leavesden, Watford, Herts.

de Havilland Propellers Ltd., Hatfield Aerodrome, Herts.

The de Havilland Aircraft Pty., Ltd., Box 30, P.O. Bankstown, N.S.W., Australia.

The de Havilland Aircraft Company of New Zealand, Ltd., Rongotai, Wellington, New Zealand.

The de Havilland Aircraft of Canada, Ltd., Postal Station L, Toronto, Canada.

The de Havilland Aircraft Company of South Africa (Pty.) Ltd., P.O. Box 7105, Johannesburg, South Africa.

The de Havilland Aircraft Company (Rhodesia) Ltd., P.O. Box 329, Salisbury, S. Rhodesia.

de Havilland Aircraft Inc., Marine Terminal, La Guardia Airport, Flushing, New York, U.S.A.

The de Havilland Aircraft Company Limited was founded at Stag Lane, Edgware, in September, 1920, although the origins of the company go back to 1908 when Geoffrey de Havilland designed and built his first aeroplane. Divisions of the company for production of Gipsy engines and variable-pitch airscrews were formed in 1928 and 1935, and overseas companies were formed in 1927 (Australia) 1928 (Canada), 1929 (India), 1930 (South Africa) and 1939 (New Zealand).

Post-war civil production began with the Dove light transport, over 450 of which have been built. This was followed in 1950 by the four-engined Heron feeder-liner, now in full production and in service in ten countries.

The company's most important undertaking in the civil field has, however, been with the Comet jet airliner. In the early months of 1954, after some 35,000 hours of test and airline flying, two accidents of B.O.A.C. Comet I's resulted in the grounding of all Comets. At the subsequent official enquiry the cause of the accidents was found to be a hitherto unsuspected manifestation of metal fatigue in the skin of the pressure cabin. Early in 1955 plans for a new modified Comet—the Comet 4—were well advanced and an order for a fleet of twenty was placed by B.O.A.C.

Developed during the war, but too late to see operational service, the Vampire single-seat jet fighter since became the most widely-adopted fighter in the world, being supplied to the Air Forces of seventeen countries.

Later development of the basic Vampire has led to the T. Mk. 11 side-by-side all-purpose jet trainer and the Venom, an advanced day, night and naval fighter powered by the larger and more powerful D.H. Ghost engine.

The latest de Havilland fighter now in production for the Royal Navy is the D.H. 110, a two-seat day and night all-weather fighter powered by two Rolls-Royce Avon engines.

Current production, in addition to the Comet, Dove and Heron, includes the Venom and Sea Venom and Vampire Trainer.

Details of the products of the Australian and Canadian de Havilland companies may be found in the "Australia" and "Canada" sections respectively.

The products of the de Havilland Engine Co., Ltd. and the Airspeed Division are to be found under their separate headings elsewhere in this volume.

THE D.H. 115 VAMPIRE TRAINER.

Development of a trainer version of the Vampire jet fighter was undertaken by the de Havilland company as a private venture. Under the designation Vampire T. Mk. 11, the trainer, one of the first to feature the principle of side-by-side seating for instructor and pupil, has been adopted as the standard advanced trainer of the Royal Air Force and the Royal Navy. It is also in service, as the Vampire T. Mk. 55, in the air forces of Australia, Burma, Chile, Egypt, Finland, India, Indonesia, Iraq, Lebanon, New Zealand, Norway, Portugal, South Africa, Rhodesia, Sweden, Switzerland and Venezuela.

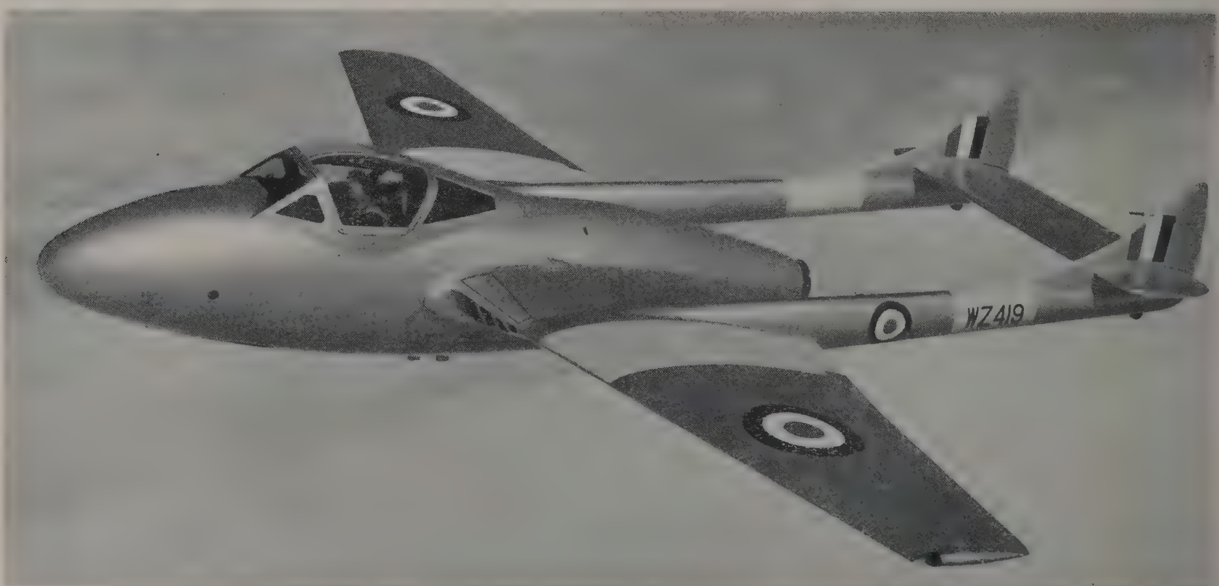
The cabin is pressurized to a differential of 3 lb./sq. in., and is entered through a rearward-opening hood. All essential cockpit controls are duplicated.

The nose-cap also hinges up to give access to certain equipment located in the forward fuselage, including a ciné-gun, radio, batteries and oxygen bottles. The normal Vampire armament of four 20 mm. cannon is retained in the fuselage belly. Rockets and bombs may also be carried.

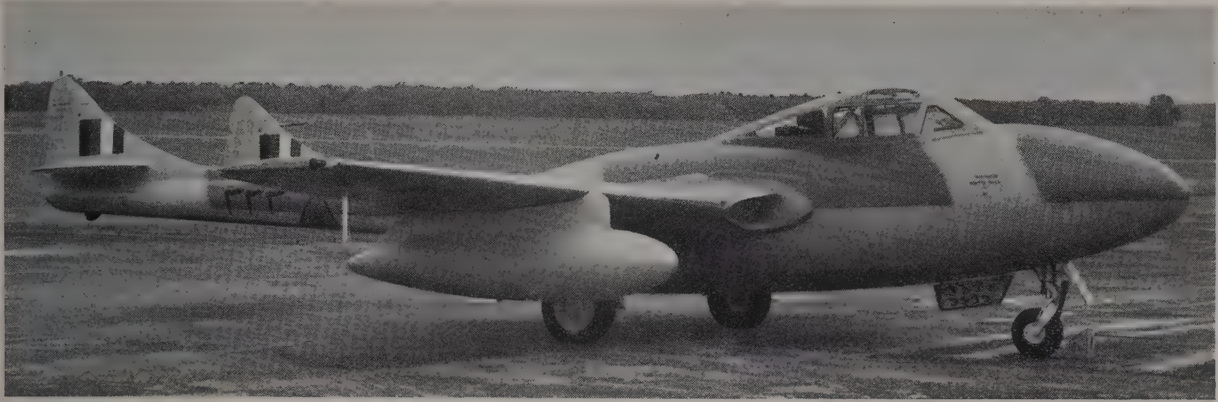
Actual detail design of the Vampire Trainer was undertaken by the Airspeed Division, at whose Christchurch works the prototype was built. The first flight of the prototype was made on November 15, 1950.

Dimensions.—
Span 38 ft. 0 in. (11.59 m.).
Length 34 ft. 6½ in. (10.51 m.).
Wing area 261 sq. ft. (24.25 m.²).

Weights.—
Weight loaded (clean) 11,150 lb. (5,060 kg.).



The D.H. Vampire T. Mk. 11 Trainer (D.H. Goblin turbojet engine).



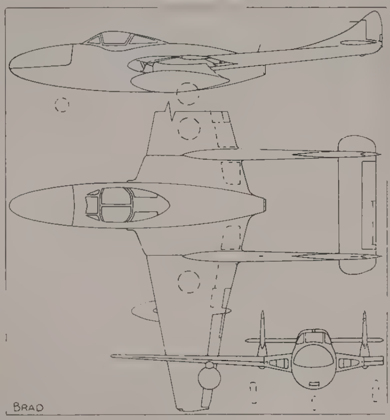
The D.H. Vampire T. Mk. 55 Trainer (D.H. Goblin turbojet engine) as supplied to the Royal Iraqi Air Force.

Weight loaded (with two 100 Imp. gal. (455 litre) drop tanks 12,920 lb. (5,860 kg.).

PERFORMANCE (Clean).—
- Max. speed at S/L. 538 m.p.h. (866 km.h.).
- Max. speed at 20,000 ft. (6,100 m.) 549 m.p.h. (885 km.h.).
- Max. speed at 40,000 ft. (12,200 m.) 521 m.p.h. (839 km.h.).
- Initial rate of climb 4,500 ft./min. (22.8 m./sec.).
- Climb to 20,000 ft. (6,100 m.) 5.6 min.
- Climb to 40,000 ft. (12,200 m.) 16.3 min.
- Still air range without external equipment 623 miles (955 km.) at 300 m.p.h. (480 km.h.) at 20,000 ft. (6,100 m.) and 853 miles (1,370 km.) at 403 m.p.h. (650 km.h.) at 40,000 ft. (12,200 m.).
- Take-off distance to 50 ft. (15.25 m.) 910 yds. (832 m.).
- Landing distance from 50 ft. (15.25 m.) 1,180 yds. (1,080 m.).
- Limiting Mach. No. without external equipment at high altitudes 0.815.

THE D.H. 114 HERON.

The Heron is the latest addition to the long line of successful de Havilland light transports. Powered by four 250 h.p. ungeared and unsupercharged Gipsy Queen 30 engines, providing a reserve of power unusual in an aircraft of this category, the Heron is now in service in twenty countries. The standard Heron airliner carries 14-17 passengers and the executive model has luxurious appointments for eight passengers. The Heron has good take-off capabilities and a short landing run and is suited to operation from small airfields with limited maintenance facilities.



The D.H. Vampire Trainer.

The Heron is available in two versions, the Series 1 with a fixed tricycle landing-gear, and the Series 2 with a retractable tricycle landing-gear.

Among the world's airline companies which have taken delivery of Herons are New Zealand National Airways; Braathen's S.A.F.E. (Norway); Transportes Aereos Salvador (Brazil); Butler Air Transport (Australia); U.A.T. (France); Indonesian Airways; Jersey Airlines; PLUNA (Uruguay); Japan Air Lines; British European Airways; Turkish Airlines; Indian Airlines; West African Airways and Dragon Airways.

A specially-fitted Heron Series 2 forms part of the equipment of The Queen's Flight. There are about ten private owners of Herons.

TYPE.—Four-engined Feeder-line or Executive Transport.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 10.5. Light alloy structure with light alloy sheet skin. Goodyear pulsating-boot leading-edge de-icing. Ailerons in outer wing panels and trailing-edge flaps inboard in three pieces each side. Ailerons and flaps have metal frames and fabric covering. Flaps pneumatically-operated. Gross wing area 499 sq. ft. (46.4 m.^{2}).

FUSELAGE.—Light alloy monocoque structure. Wing centre-section spar integral with fuselage. Main cabin floor of sandwich construction, stressed for freight carrying.

TAIL UNIT.—Cantilever monoplane type. Metal frames with fixed surfaces metal-covered and movable surfaces fabric-covered. Tailplane span 21 ft. 0 in. (6.4 m.).

LANDING GEAR.—Fixed (Series 1) or retractable (Series 2) tricycle type. Retractable type is pneumatically-operated. In both types of landing-gear each main leg has rubber shock absorbers. Nosewheel has an oleo-pneumatic shock-absorber and is castoring and self-centering. Pneumatic brake operation. Track Series 1 15 ft. 9 in. (4.8 m.), Series 2 16 ft. 8 in. (5.1 m.).

POWER PLANT.—Four 250 h.p. D.H. Gipsy Queen 30 Mk. 2 six-cylinder in-line air-cooled direct-drive unsupercharged engines. All engines on their bearers are interchangeable. D.H. 2/1000/2 bracket-type constant-speed two-blade airscrews, diameter 7 ft. (2.14 m.), feathering optional.

The D.H. Heron Series I Light Transport (four 250 h.p. D.H. Gipsy Queen 30 Mk. 2 engines).

The D.H. Heron Series I Light Transport (four 250 h.p. D.H. Gipsy Queen 30 Mk. 2 engines).

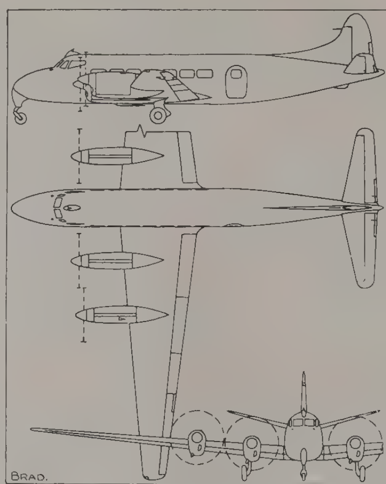
Bag-type fuel tanks in each wing root, inboard of inner engines. Maximum fuel capacity 316 Imp. gallons (1,435 litres).

ACCOMMODATION.—Crew of two side-by-side in separate cockpit forward. Main passenger accommodation normally arranged for fourteen passengers in single seats each side of central aisle, with toilet at rear. Total cabin capacity 475 cub. ft. (13.45 m.^{3}). Luggage bay at rear, capacity 105 cub. ft. (2.97 m.^{3}). Alternative accommodation for fifteen passengers, with smaller toilet compartment and rear luggage bay capacity 70 cub. ft. (1.98 m.^{3}), or for 17 passengers with no toilet and rear luggage bay capacity 45 cub. ft. (1.27 m.^{3}). In each arrangement there is a front luggage compartment, capacity 24 cub. ft. (0.68 m.^{3}) in Series 1, 22 cub. ft. (0.623 m.^{3}) in Series 2. Entrance at rear on port side. Headroom in cabin 5 ft. 8½ in. (1.77 m.).

EQUIPMENT.—Full radio, including Marconi AD97/108 transmitter-receiver, Marconi AD7092 or AD7092A Automatic Radio Compass, and Standard STR9X V.H.F. Provision for Marconi blind-approach equipment, standard STR12 V.H.F. or Murphy MR60B V.H.F. radio, and Sperry A.L.Ia. autopilot.

DIMENSIONS.—
Span 71 ft. 6 in. (21.8 m.).
Length 48 ft. 6 in. (14.8 m.).
Height 15 ft. 7 in. (4.75 m.).

WEIGHTS (Series 1—fixed L/G.).—
Tare weight (including radio) 7,985 lb. (3,623 kg.).
Crew (2) 330 lb. (150 kg.).
Fuel (typical case) for 400 mile (644 km.) stage with I.F.R. allowances (201 Imp. gal. = 913 litres) 1,445 lb. (655 kg.).
Oil (18.1 Imp. gal. = 82.3 litres) 162 lb. (73 kg.).
Payload (including 14 passengers) 3,078 lb. (1,396 kg.).
Weight loaded 13,000 lb. (5,897 kg.).



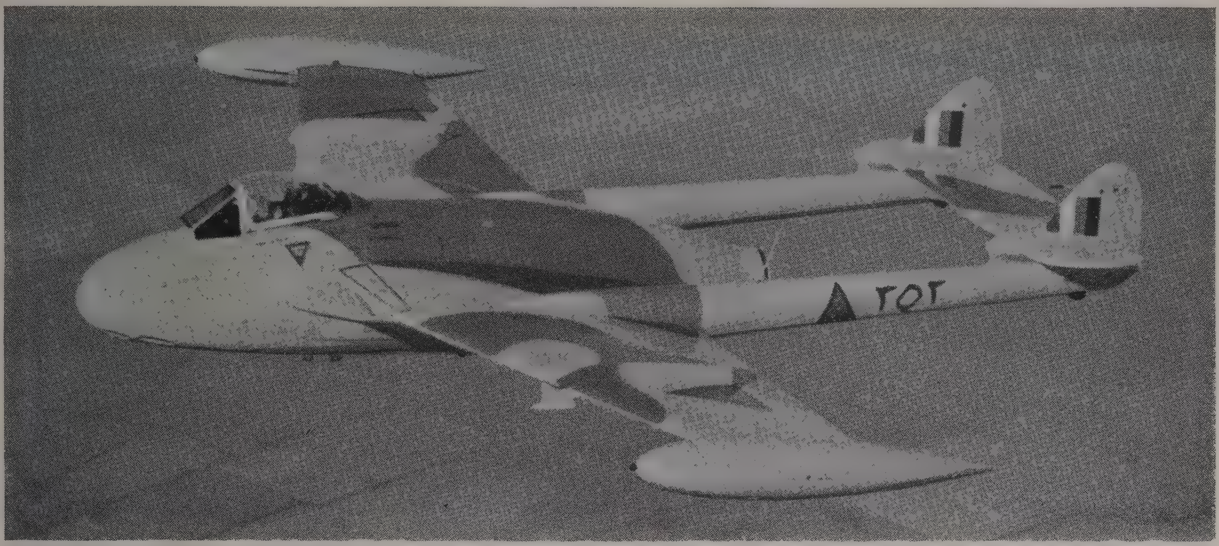
The D.H. Heron Series I.

WEIGHTS (Series 2—retractable L/G.).—
Tare weight (incl. radio) 8,150 lb. (3,697 kg.).
Crew (2) 330 lb. (150 kg.).
Fuel (typical case) for 400 mile (644 km.) stage with I.F.R. allowances (183 Imp. gal. = 832 litres) 1,320 lb. (599 kg.).
Oil (16.3 Imp. gal. = 74.1 litres) 146 lb. (66 kg.).
Payload 3,054 lb. (1,385 kg.).
Weight loaded 13,000 lb. (5,897 kg.).

PERFORMANCE (Series 1).—
Cruising speed at 8,000 ft. (2,440 m.) at 65% METO power 165 m.p.h. (266 km.h.).
Weak mixture cruising at 3,000 ft. (915 m.) 174 m.p.h. (280 km.h.).
Rate of climb at S/L. 1,060 ft./min. (5.37 m./sec.).
Rate of climb at S/L. on three engines 550 ft./min. (2.78 m./sec.).
T.O. distance to 50 ft. (15.2 m.), hard runway, airline method 750 yds. (685 m.).
T.O. distance to 50 ft. (15.2 m.) with one engine cut at safety speed 865 yds. (790 m.).
Landing distance from 50 ft. (15.2 m.) 665 yds. (610 m.).

PERFORMANCE (Series 2).—
Cruising speed at 8,000 ft. (2,440 m.) at 65% METO power 183 m.p.h. (295 km.h.).
Weak mixture cruise at 3,000 ft. (915 m.) 191 m.p.h. (307 km.h.).
Rate of climb at S/L. 1,140 ft./min. (5.79 m./sec.).
Rate of climb at S/L. on three engines 610 ft./min. (3.11 m./sec.).
T.O. and landing distances similar to Series 1.

The D.H. Heron Series 2 which forms part of the equipment of The Queen's Flight.



The D.H. Venom F.B. Mk. 50 Single-seat Fighter-bomber (D.H. Ghost turbojet engine) as supplied to the Royal Iraqi Air Force.

THE D.H. 112 VENOM.

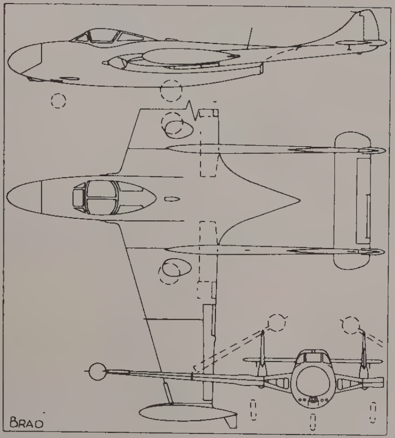
The Venom is a straightforward development of the Vampire designed to accommodate the de Havilland Ghost engine, and with aerodynamic refinements to enable the aircraft to take full advantage of the increased power.

The nacelle and tail assembly are similar to Vampire components. The wing, however, is different, and is a square-tipped unit of thin section, carrying jettisonable long-range tanks at the extreme tips. The tanks are designed to be retained in combat.

The following are the principal versions of the Venom :—

Venom F.B. Mk. 1. Single-seat day fighter and fighter-bomber. Provision for bombs or rockets beneath wings, or two long-range fuel tanks, in addition to wing-tip tanks. First flight at Hatfield on September 2, 1949.

Venom N.F. Mk. 2. Two-seat night and all-weather fighter, seating two side-by-side and carrying radar in lengthened nose.



The D.H. Sea Venom F. (A.W.) 21.

Venom N.F. Mk. 3. Development of N.F. Mk. 2 fitted with special combat equipment and power-operated controls. In service in the Royal Air Force.

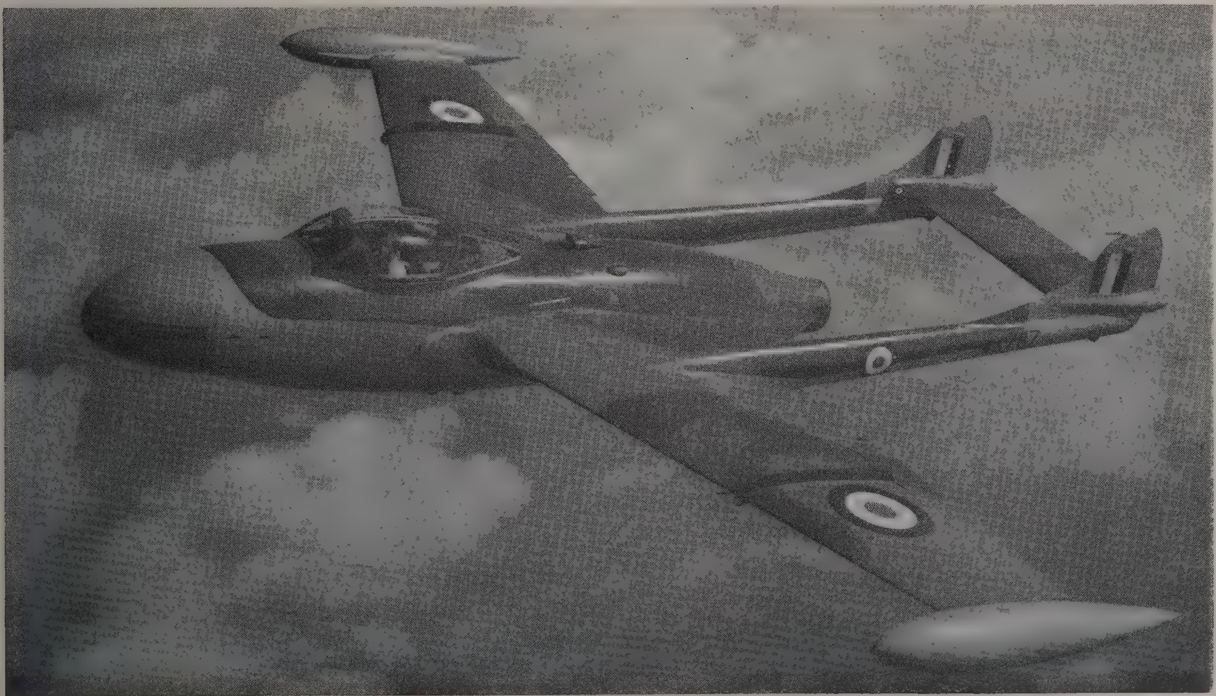
Venom F.P. Mk. 4. Development of F.B. Mk. 1 with control refinements. In service in Royal Air Force and ordered by Venezuelan Air Force.

Sea Venom F. (A.W.) Mk. 20. Naval version of the Venom N.F. Mk. 2, in service with the Royal Navy as a two-seat all-weather fighter. Fitted with power-folding wings, catapult gear and arrester gear.

Sea Venom F. (A.W.) Mk. 21. Improved Mk. 20 with special combat equipment, power-jettisonable clear vision hood and power-operated controls. In service in the Royal Navy.

Venom F.P. Mk. 50. Export version of F.B. Mk. 1 for Swiss and Royal Iraqi Air Forces. Being built under licence in Switzerland.

Venom N.F. Mk. 51. Export version of N.F. Mk. 2 for the Royal Swedish Air Force.



The D.H. Venom N.F. Mk. 3 Two-seat Night Fighter (D.H. Ghost turbojet engine).

The D.H. Sea Venom F. (A.W.) Mk. 21 Two-seat All-weather Fighter (D.H. Ghost turbojet engine).

Sea Venom Mk. 52. Export version of Mk. 20 for French Navy. Being built under licence in France by Société Nationale de Constructions Aéronautiques de Sud-Est and named "Aquilon." Powered by Fiat-built D.H. Ghost 48 engine. First production Aquilon flew on March 25, 1954.

Sea Venom Mk. 53. Export version of Mk. 21 for Royal Australian Navy.

Dimensions.—
Span 41 ft. 9 in. (12.7 m.).
Length (F.B. Mk 4) 33 ft. (10 m.)
Length (Sea Venom Mk. 21) 35 ft. 3 in. (10.7 m.).

THE D.H. 110.

The D.H. 110 is a two-seat day and night all-weather fighter which is in production for the Royal Navy. It is powered by two Rolls-Royce Avon turbojet engines and is equipped with the latest electronic combat and navigational aids. A recent modification is the fitting of an all-moving tailplane to increase manoeuvrability at transonic and supersonic speeds. No further details of this aircraft are available for publication.

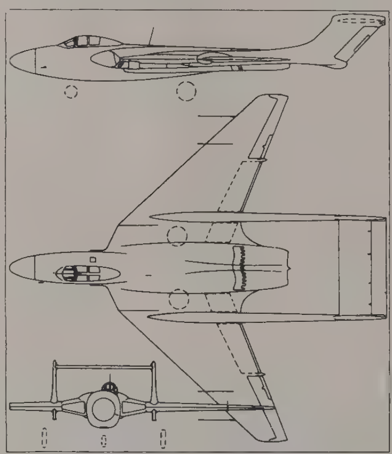
Dimensions.—
Span 51 ft. (15.5 m.).
Length 52 ft. 1½ in. (15.9 m.).

THE D.H. 106 COMET.

Based on the findings of the Court of Enquiry, which was set up to study the circumstances of the two accidents which occurred to Comet IA's of B.O.A.C. in January and April, 1954, and following the statements made by the British Government in February, 1955, a new production programme for the Comet has been drawn up.

Production in the main will be concentrated on the Comet 4, of which British Overseas Airways Corporation has ordered a fleet of twenty. The Comet 4 is a straightforward projection of the Comet 3 and supersedes that model. It will incorporate all the improvements accumulated in six years of Comet development and operation, including 30,000 hours of airline service and the technical investigation of 1954 which was without precedent in aeronautical engineering.

B.O.A.C.'s decision to concentrate on the Comet 4 in the interests of standardisation and for the timing of the Corporation's traffic development and fleet requirements, facilitates the de Havilland programme and will permit an earlier introduction of this version.



The D.H. 110 All-weather Fighter.

The Comet 2, also improved in accordance with the knowledge gained in the extensive work done by de Havilland and the R.A.F. in 1954, is now offered as a medium-stage intercontinental airliner and will be available at an earlier date than the Comet 4. The Royal Air Force has ordered Comet 2's for the high-speed operations of Transport Command and there will be a single specification for the R.A.F. and civil versions.

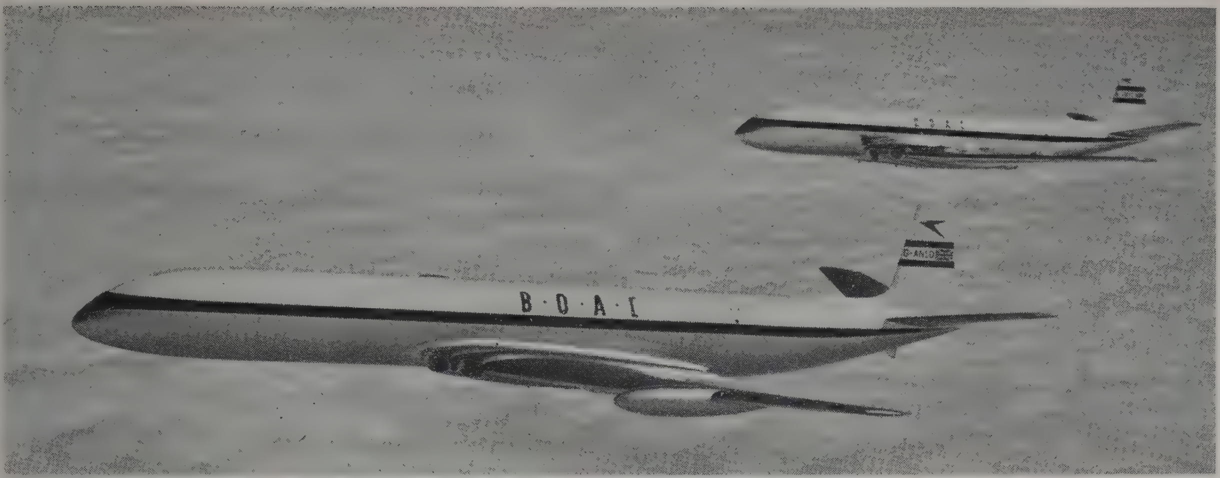
Brief details of the current versions of the Comet follow.

Comet 2. Four Rolls-Royce Avon R.A.25 turbojet engines (7,350 lb.=3,336 kg. s.t. each). Re-designed fuselage. Capacity payload of 13,000 lb. (5,900 kg.), can be carried over stages of up to 2,400 miles (3,862 km.). A.U.W. 120,000 lb. (54,432 kg.). The first Comet 2 made its first flight on August 27, 1953. In production for R.A.F. Transport Command.

Comet 3. Four Rolls-Royce Avon R.A. 26 turbojet engines (10,000 lb.=4540 kg. s.t. each). Development prototype for Comet 4. Production not envisaged. First flight on July 14, 1954.

Comet 4. Four Rolls-Royce Avon R.A.29 turbojet engines (10,500 lb.= 4,767 kg. s.t. each). The Comet 4, announced in March, 1955, is a logical development of the Comet 3, which it superseded. It differs from the Mark 3

The D.H. 110 Two-seat Naval Day and Night All-weather Fighter (two Rolls-Royce Avon turbojet engines).



The D.H. prototype Comet 2 (background) and 3 (foreground) Airliners in flight together.

in having a redesigned fuselage, increased power, reduced fuel consumption and increased tankage, resulting in improved range/payload capabilities. The Comet 4 will carry its capacity payload (58 first class passengers) over a stage length, allowing for reserves for climb, descent, head-winds, stand-off and diversions, of 2,870 miles (4,590 km.). All-up weight 152,500 lb. (69,235 kg.). First deliveries of the Comet 4 will be made in the latter part of 1958. Twenty ordered by B.O.A.C.

Details of the main features and performance of the Comets 2, 3 and 4 released to date are set out below.

Type.—Four-engined Jet Airliner.

Wings.—Low-wing cantilever monoplane with moderate sweepback, with two jet engines accommodated in each stubwing, passing through the front and rear spar webs. Integral and bag-type fuel tanks and thermal de-icing. Air brakes are fitted. Plain flaps outboard of the engines and split flaps inboard, with hydraulic operation. Extensive use of Redux metal-to-metal bonding. Chord 29 ft. 6 in. (9.0 m.) at root, 6 ft. 9 in. (2.06 m.) at tip. Gross wing area (Comet 2) 2,015 sq. ft. (187.2 m.^{2}), (Comet 3 and 4) 2,121 sq. ft. (197 m.^{2}).

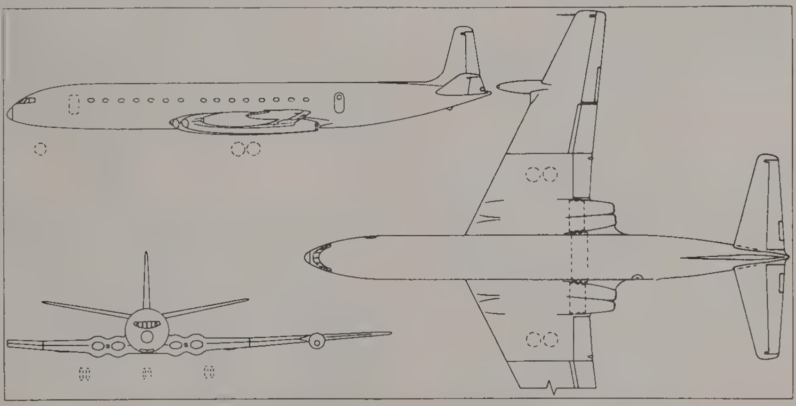
Fuselage.—Of circular cross section, 10 ft. (3.05 m.) in diameter throughout length of cabin. A pressure dome seals the aft end of the cabin. Redux bonding used extensively.

Tail Unit.—Cantilever monoplane tailplane and single fin and rudder. Tailplane span Comet 2 42 ft. 8 in. (12.0 m.), Comet 3 and 4 47 ft. 5 in. (14.45 m.).

Landing Gear.—Retractable tricycle type of de Havilland design. Each main unit carries a four-wheel bogie retracting outwards into wings. Doors retract when undercarriage is down. Twin-wheel nose unit is steerable and retracts backwards into fuselage. Hydraulic retraction. Wheel track (shock-strut centres)) Comet 2 28 ft. 5 in. (8.66 m.), Comet 3 and 4 28 ft. 2 in. (8.58 m.). Wheel base (shock-strut centres) Comet 2 34 ft. 11 in. (10.64 m.), Comet 3 and 4 46 ft. 8 in. (14.22 m.).

Power Plant.—Four Rolls-Royce Avon (7,350 lb.=3,336 kg. s.t. each) (Comet 2), or Rolls-Royce Avon (10,500 lb.=4,767 kg. s.t. each) (Comet 4). Hinged panels below wings expose whole installations for easy servicing from ground. Quickly-detachable air intake and tail pipe connections and special disconnect-joints in engine control connecting rods. Installation is split into three temperature zones, each zone being separated by fire-proof bulkhead and having its own ventilators and fire-extinguishing system. Fuel in integral and flexible bag-type wing tanks and flexible bag tanks in centre-section, with pressure refuelling. Comet 3 and 4 have projecting leading-edge tanks. Fuel capacities: Comet 2 7,000 Imp. gallons (31,750 litres), Comet 3 8,360 Imp. gallons (38,000 litres), Comet 4 8,750 Imp. gallons (39,725 litres).

Accommodation.—Flight deck forward, with accommodation for two pilots with full dual control, flight engineer, and radio-operator/navigator. Seating capacities: Comet 2 44 passengers, Comet 4 58/76 passengers. Flight deck, cabin and freight compartments pressurised to 8¾ lb./sq. in. (0.6 kg./cm.^{2}) by air tapped from the engine compressors, giving a cabin altitude of 8,000 ft. (2,436 m.) when the aircraft is at 40,000 ft. (12,120 m.). Comet 2 pressurised



The D.H. Comet 4 Airliner.

The D.H. prototype Comet 3 Airliner (four Rolls-Royce Avon turbojet engines).

The D.H. Dove Light Transport (two 380 h.p. D.H. Gipsy Queen 70 Mk. 2 engines).

to a slightly lower figure. All versions have galley and adequate toilet, wardrobe and dressing amenities. Main passenger door in port side at end of cabin, and crew door, forward in starboard side; both open inwards and measure 4 ft. 8 in. × 2 ft. 6 in. (1.43 m. × 0.761 m.). Freight capacities: rear hold floor Comet 3 and 4 155 cub. ft. (4.387 m.³); rear hold (under floor) Comet 2 185 cub. ft. (5.236 m.³), Comet 3 and 4 240 cub. ft. (6.792 m.³); front hold (above floor), Comet 2 212 cub. ft. (6.0 m.³) port, 34 cub. ft. (0.962 m.³) starboard; front hold (below floor) Comet 3 and 4 150 cub. ft. (4.245 m.³).

DIMENSIONS.—
- Span 115 ft. (35 m.).
- Length (Comet 2) 96 ft. (29.26 m.).
- Length (Comet 3 and 4) 111 ft. 6 in. (33.99 m.).
- Height (on ground—over fin) 28 ft. 4½ in. (8.65 m.).

WEIGHTS (Comet 2).—
- Capacity payload 13,000 lb. (5,900 kg.).
- Weight loaded 120,000 lb. (54,432 kg.).

WEIGHTS (Comet 4).—
- Capacity payload 16,850 lb. (7,650 kg.).
- Weight loaded 152,500 lb. (69,235 kg.).

PERFORMANCE.—
- Cruising speed (Comet 2) 490 m.p.h. (784 km.h.).
- Cruising speed (Comet 3 and 4) 500 m.p.h. (800 km.h.).

THE D.H. 104 DOVE.

Over 450 Dove light transports are now operating in a variety of rôles all over the World. The standard commercial model has accommodation for eight/eleven passengers, but variants have been designed for survey, pest-control, executive and ambulance duties.

The basic versions of the Dove are as follows:—

Series 1. Standard 8/11-seater. Two 340 h.p. D.H. Gipsy Queen 70 engines. A.U.W. 8,500 lb. (3,855 kg.).

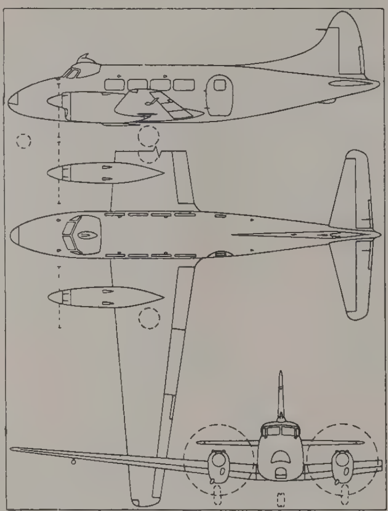
Series 2. Same as Series 1 but with special executive interior furnishings.

Series 3. Design study only.

Series 4. R.A.F. Devon C. Mk. 1. Military modification of the 8-passenger Series 1.

Series 5. Two 380 h.p. D.H. Gipsy Queen 70 Mk. 2 engines. Installation of this engine requires no modifications to the standard Dove engine bearer structure, pipe lines and control runs. Twenty per cent. increase in pay-load over 500 mile (800 km.) stage as compared with Series 1. A.U.W. 8,800 lb. (3,992 kg.).

Series 6. Same as Series 5 but with special executive interior.



The D.H. Dove Light Transport.

The Dove is also available as a fully-equipped navigational radio trainer, air mapping trainer, survey aircraft, or as an ambulance.

TYPE.—Twin-engined eight/eleven-passenger Light Transport.

WINGS.—Cantilever low-wing monoplane. Piercy aerofoil section, max. thickness at 35% chord. Root chord 8 ft. 8 in. (2.64 m.); tip chord 2 ft. 6½ in. (.77 m.); aspect ratio 9.7; incidence 2 degrees, dihedral (top front spar) 4 degrees. All-metal structure with stressed aluminium-alloy Redux-bonded skin riveted to spars and ribs. Mass-balanced aluminium-alloy ailerons. Trim-tab in each, adjustable on ground only. Pneumatically - operated plain-hinge flaps in two sections each side. Total aileron area 10.9 sq. ft. (1 m.²). Total flap area 19.8 sq. ft. (1.84 m.²). Gross wing area 335 sq. ft. (31.12 m.²).

FUSELAGE.—Oval-section monocoque structure with Redux-bonded stressed aluminium-alloy skin.

TAIL UNIT.—Cantilever monoplane type. Light-alloy structure with metal-covered fixed surfaces and fabric-covered elevators and rudder. Tailplane adjustable for incidence on ground. Elevators interchangeable left and right. Controllable metal trim-tabs in rudder and elevators. Fin area 20.4 sq. ft. (1.89 m.²). Rudder area 13.75 sq. ft. (1.27 m.²). Tailplane area 35.46 sq. ft. (3.28 m.²). Elevator area (total) 24.5 sq. ft. (2.27 m.²).

LANDING GEAR.—Retractable tricycle type. Rubber - in - compression shock - absorber legs interchangeable left and right. Dunlop wheels, tyres and brakes. Nose-wheel on Lockheed air-oil shock-absorber strut. Dunlop nose-wheel with Marstrand two-track tyre. Pneumatic retraction, with separate emergency system. Track 13 ft. 8 in. (4.16 m.). Wheel base 13 ft. 0 in. (3.96 m.).

POWER PLANT.—Two de Havilland Gipsy Queen 70 Mk. 2 geared and supercharged six-cylinder in-line inverted air-cooled engines rated at 355 b.h.p. at 4,250 ft. (1,296 m.) and with 380 b.h.p. available for take-off. Engines complete with oil tank and all accessories form self-contained units which are quickly detachable and interchangeable right and left. D.H. Hydromatic 1,000 three-blade constant-speed feathering airscrews 7 ft. 6 in. (2.28 m.) diameter. Total fuel capacity 168 Imp. gallons (764 litres).

ACCOMMODATION.—Enclosed cockpit seating pilot and co-pilot/radio-operator side-by-side with dual controls. Main cabin, ventilated and sound-proofed, has accommodation for eight passengers in four seats on each side of central aisle. Main entry door, 2 ft. 3 in. (0.68 m.) from ground on port side aft of rear cabin bulkhead, with another door into cabin. Toilet on starboard side of vestibule opposite main entry door. Rear cabin bulkhead and lavatory can be removed to provide a ninth passenger seat. In eleven-passenger version bulkhead aft of vestibule removed and two further seats installed. Main cabin 11 ft. 9 in. long × 5 ft. 2½ in. wide × 4 ft. 6 in. high (3.58 m. × 1.58 m. × 1.37 m.). Volume 246 cub. ft. (6.96 m.³). Two emergency exits in roof. Forward luggage compartment under floor of cockpit with volume of 22 cub. ft. (0.62 m.³). Max. load 300 lb. (136 kg.). Aft luggage compartment (on eight-nine seat aircraft) with volume of 45 cub. ft. (1.27 m.³). Max. load 600 lb. (272 kg.). On eleven-seat aircraft 30 cub. ft. (0.85 m.³) luggage space available aft of rear seats.

DIMENSIONS.—
- Span 57 ft. 0 in. (17.40 m.).
- Length 39 ft. 3 in. (11.96 m.).
- Height (over rudder) 13 ft. 4 in. (4.06 m.).
- Height (over cockpit canopy) 8 ft. 10 in. (2.69 m.).

WEIGHTS AND LOADINGS (Series 5 and 6).—
- Weight empty (equipped) 5,725 lb. (2,597 kg.).
- Crew (2) 330 lb. (150 kg.).
- Fuel (for 400 miles = 645 km.) 845 lb. (383 kg.).
- Oil 84 lb. (38 kg.).
- Payload 1,816 lb. (824 kg.).
- Weight loaded 8,800 lb. (3,992 kg.).
- Wing loading 26.3 lb./sq. ft. (128.2 kg./m.²).
- Power loading 11.58 lb./h.p. (5.66 kg./h.p.).

PERFORMANCE (Series 5 and 6).—
- Max. weak mixture cruising speed at 8,000 ft. (2,440 m.) 202 m.p.h. (325 km.h.).
- Cruising speed at 60% M.E.T.O. power at 8,000 ft. (2,440 m.). 179 m.p.h. (288 k.mh).

Rate of climb at sea level 920 ft./min. (4.67 m./sec.).
Rate of climb on one engine at M.E.T.O. power 220 ft./min. (1.12 m./sec.).
Stage length with 1,500 lb. (680 kg.) payload without extra tanks under V.F.R. conditions 850 miles (1,368 km.).
Take-off distance to 50 ft. (15 m.) 810 yds. (740 m.).
Landing distance from 50 ft. (15 m.) 640 yds. (585 m.).
Fuel consumption at cruising speed 27.3 Imp. gallons per hour (124 litres per hour) (6.55 m.p.g.=2.32 km. per litre).
Fuel consumption at max. weak mixture cruising speed 35 Imp. gallons per hour (159 litres per hour) (5.77 m.p.g.=2.04 km. per litre).

THE D.H.C. 1 CHIPMUNK.

The Chipmunk, a primary trainer designed by the Canadian de Havilland Company, is in production both in Canada and England. Twenty-two Air Forces, including both the Royal Canadian Air Force and the Royal Air Force, are using Chipmunks, while the aircraft is in use in numerous civil flying schools.

Type.—Two-seat Primary Trainer.

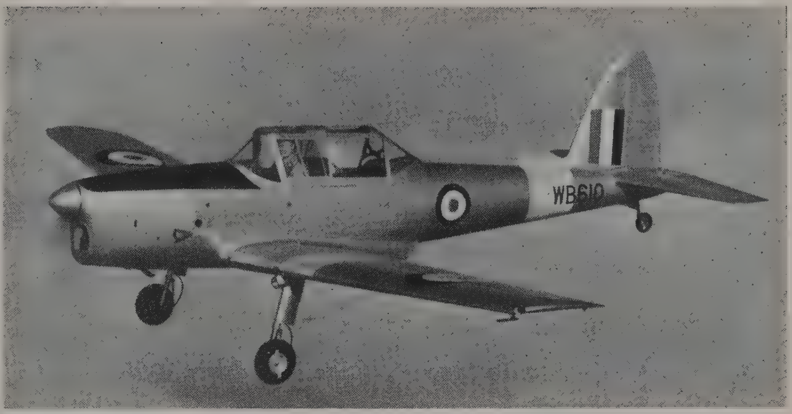
Wings.—Cantilever all-metal low-wing monoplane. Pitot head-on port wing, whip aerial on starboard. Gross wing area 172 sq. ft. (15.98 m.²).

Fuselage.—All-metal semi-monocoque in two sections.

Tail Unit.—Ground adjustable tab on rudder. Bowden-operated trim-tab on starboard elevator only. Dorsal fin integral with rear fuselage, incorporating top rail for sliding cockpit canopy. Tailplane area 17 sq. ft. (1.58 m.²). Elevator area 14 sq. ft. (1.3 m.²). Fin area 5.9 sq. ft. (0.55 m.²). Rudder Area 6.8 sq. ft. (0.63 m.²).

Landing Gear.—Fixed cantilever rubber-in-compression shock struts carry Dunlop wheels with single-disc hydraulic brakes. Castoring tail-wheel. Landing and taxying light is installed in top of port leg fairing.

Power Plant.—One 145 h.p. de Havilland Gipsy Major 8 or 10 Mk.2 four-cylinder inverted air-cooled unsupercharged engine, with fixed-pitch metal Fairey-Reed airscrew, diameter 6 ft. 10 in. (2.1 m.). Cartridge starter, generator and vacuum pump. One fuel tank in each wing root, capacity 9 Imp. gallons (41 litres) each.



The D.H.C.I Chipmunk T. Mk. 10 (145 h.p. D.H. Gipsy Major 8 engine).

Accommodation.—Tandem cockpits for pupil and instructor with all controls and instruments fully duplicated. Full standard blind flying panels. V.H.F. (S.T.R.9) radio and intercomm. Common sliding canopy covers both cockpits. Windscreen frame re-inforced as crash pylon. Bucket seats fitted with Z-type safety harness. Removable and sliding amber screens are fitted for synthetic night training.

Dimensions.—
Span 34 ft. 4 in. (10.46 m.).
Length 25 ft. 5 in. (7.75 m.).
Height 7 ft. 0 in. (2.13 m.).

Weights (Military T. Mk. 20).—
Weight empty 1,425 lb. (647 kg.).
Crew (2) with parachutes 400 lb. (182 kg.).
Fuel (full tanks) 130 lb. (59 kg.).
Oil 23 lb. (10 kg.).
Removable load 6 lb. (163 kg.).
Normal loaded weight 2,014 lb. (914 kg.).
Max. permissible A.U.W. 2,100 lb. (953 kg.).

Weights (Civil Mk. 21).—
Weight empty 1,430 lb. (649 kg.).
Crew (2) with parachute 400 lb. (182 kg.).
Fuel (full tanks) 173 lb. (78 kg.).
Oil 23 lb. (10 kg.).
Removable load 30 lb. (14 kg.).
Normal loaded weight 2,056 lb. (933 kg.).
Max. permissible A.U.W. 2,100 lb. (953 kg.).

Performance (at 2,100 lb. = 953 kg. A.U.W.).—
Max. speed at S/L. 138 m.p.h. (222 km.h.).
Cruising speed at S/L. 119 m.p.h. (191 km.h.).
Rate of climb at S/L. 840 ft./min. (4.27 m./sec.).
Service ceiling 15,800 ft. (4,820 m.).
Range at 116 m.p.h.=187 km.h. at 5,000 ft.=1,525 m. with allowance for T.O. and climb Mk. 20 280 miles (445 km.) Mk. 21 380 miles (610 km.).
Endurance at 5,000 ft. (1,525 m.) Mk. 20 2.3 hrs., Mk. 21 3.2 hrs.

ENGLISH ELECTRIC

THE ENGLISH ELECTRIC COMPANY LTD.

Head Office: Queen's House, Kingsway, London, W.C.2.

Works, Aircraft Division: Preston, Lancs.

Directors: Sir George H. Nelson, F.C.G.I., M.I.Mech.E., M.I.E.E. (Chairman and Managing Director), H. G. Nelson, A.M.I.C.E., A.I.Mech.E., A.M.I.E.E. (Deputy Managing Director), Sir Edward Crowe, K.C.M.G., Brig.-General Wade H. Hayes, O.B.E., P. Horsfall, Dr. C. P. Snow, C.B.E., Ph.D., Sir Edward Wilshaw, K.C.M.G., Sir John Woods, G.C.B., M.V.O., Lord Caldecote, D.F.C. and Godfrey Phillips.

Chief Engineer, Aircraft Division: F. W. Page, B.A., F.R.Ae.S.

Chief Designers: F. D. Crowe, B.Sc. (Eng.), A.F.R.Ae.S. and A. E. Ellison, A.M.I.Mech.E.

The English Electric Co., Ltd. was formed in 1918 by the amalgamation of Dick Kerr & Co., Ltd., of Preston; the Coventry Ordnance Works, Ltd., of Coventry; the Phoenix Dynamo Manufacturing Co., Ltd., of Bradford; Willans & Robinson, Ltd., of Rugby; and the Siemens Dynamo Works of Stafford. The first three companies mentioned had had considerable experience in aircraft design and construction, dating back in the case of the Coventry Ordnance Works to 1911. Dick Kerr and Phoenix Dynamo between them were the largest producers of seaplanes and flying-boats in World War I.

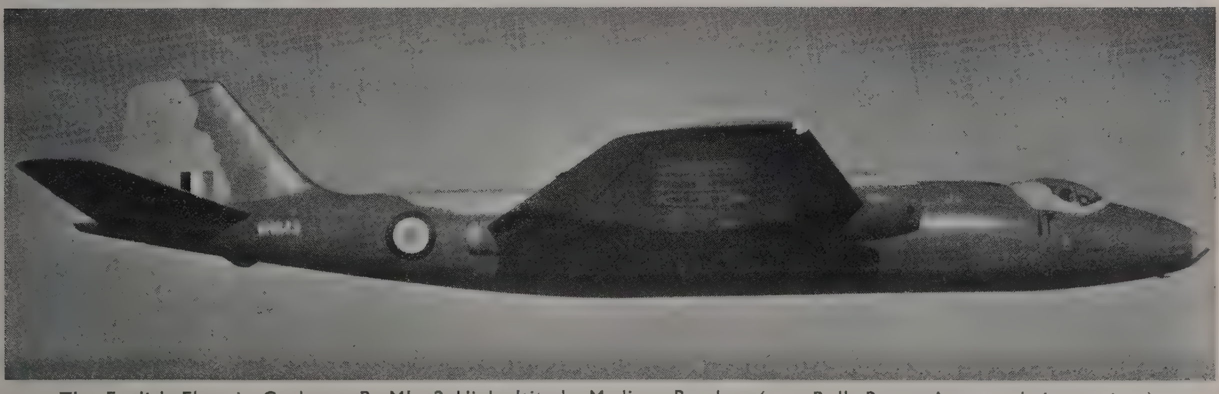
The then newly-formed English Electric Co., Ltd., retained an aircraft department and continued to design and build flying-boats of its own design. Owing, however, to lack of orders this department was closed down in 1926.

Aircraft manufacture was resumed at Preston in 1938 when production of the Handley Page Hampden was undertaken, and this was followed by the Halifax. In all, 850 Hampdens and 2,145 Halifaxes were built by English Electric. English Electric also undertook the first production of the D.H. Vampire in April, 1944, because of the preoccupation of the de Havilland company with other important work in the latter part of the war.

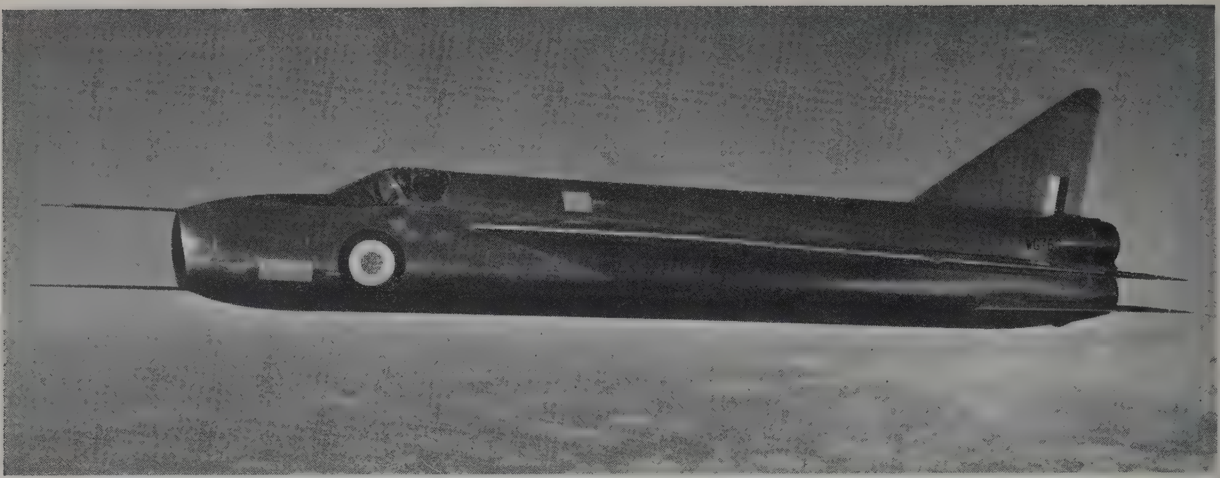
After the war, English Electric elected to remain in the Aircraft Industry and established its own technical and design organization. The first aircraft of English Electric design since 1926, is the Canberra twin-jet bomber, which is in production for the Royal Air Force by English Electric and by Short Bros. & Harland, Ltd.

The Canberra is also in production at the Australian Government factory at Fishermen's Bend, Melbourne, Victoria, for the R.A.A.F.

The Canberra is also being built in the United States by the Glenn L. Martin Company, Baltimore, Md. under the U.S.A.F. designation B-57. This version is powered by two Wright J65 Sapphire turbojets. For further details see under "Martin" (U.S.A.).



The English Electric Canberra B. Mk. 2 High-altitude Medium Bomber (two Rolls-Royce Avon turbojet engines).



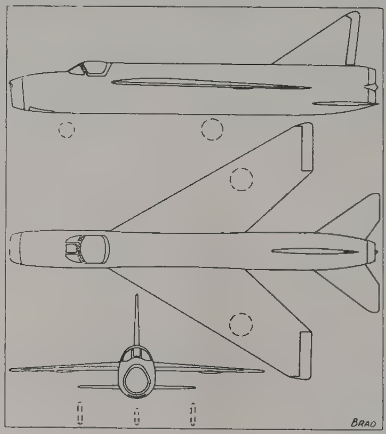
The first prototype English Electric P-1 (two Armstrong Siddeley Sapphire turbojet engines).

THE ENGLISH ELECTRIC P-1.

The P-1, which made its first flight on August 4, 1954, is the first British aircraft to be designed to be capable of exceeding the speed of sound in level flight.

No details of the P-1, other than that it is powered by two Armstrong Siddeley Sapphire turbojet engines, were available for publication at the time of closing for press, but the general appearance of the first prototype P-1 can be gathered from the accompanying illustration. In its ultimate form the P-1 will be a single-seat supersonic interceptor fighter.

In order to accelerate development and service trials, a pre-production order for twenty P-1's has been placed by the Ministry of Supply.



The English Electric P-1.

THE ENGLISH ELECTRIC A.1 CANBERRA.

Designed to Specification B.3/45, the Canberra is powered by two Rolls-Royce Avon axial-flow turbojet engines. The first prototype (VN799) flew for the first time on May 13, 1949. Deliveries of the first production Canberras to the Royal Air Force began in January, 1951.

Canberra B. Mk. 1. This designation refers only to the first four aircraft built. These were two-seat medium bombers, with "solid" nose. The second aircraft had Rolls-Royce Nene engines for experimental flying, the other three being powered by Rolls-Royce Avons with electric starters.

Canberra B. Mk. 2. Two Rolls-Royce Avon 1 engines, with cartridge-operated turbo-starters. First production version. Three-seat medium bomber, with transparent nose cone. Cabin pressurisation from engine compressors in place of two-stage blower on Mk. 1. Crew consists of pilot, navigator/plotter and observer, the two latter being trained navigators. Former navigates by radar on to target, latter acts as bomb-aimer over target. Radio is pilot-operated.

Canberra P.R. Mk. 3. Similar to the B. Mk. 2 but carries equipment for high altitude photographic reconnaissance, and lacks the offset bomb-aiming panel in the transparent nose cap. Length 66 ft. 8 in. (20.3 m.).

Canberra T. Mk. 4. Trainer version of B. Mk. 2. Crew of three comprising a pupil and instructor seated side-by-side with dual controls and a navigator behind.

Canberra B. Mk. 5. Target marker version of B. Mk. 2. Solid nose with large optically-flat bomb-aimer's panel beneath nose. Not in production.

Canberra B. Mk. 6. Similar to Mk. 2 but with the more powerful Avon RA.14 engines and additional fuel capacity.

Canberra P.R. Mk. 7. Similar to Mk. 3 but with the more powerful Avon RA.14 engines and additional fuel capacity.

Canberra B. Mk. 8. Long-range Night Interdictor or High-altitude Bomber and Target Marker, and readily convertible from one rôle to the other. For interdictor duties a heavy forward-firing armament, consisting of four 20 mm. cannon, controlled by the pilot, is carried in a detachable fairing beneath the bomb-bay, while a variety of weapons can be carried under the wings. Pilot's cockpit with fighter-type canopy offset slightly to port, navigator's position in nose of fuselage. Same power-plant and increased fuel capacity as in Mks. 6 and 7. First B. Mk. 8 flew for the first time on July 23, 1954.

Canberra P.R. Mk. 9. High-altitude photographic reconnaissance aircraft to replace the P.R.7. Span increased by 4 ft. (1.22 m.) and chord of centre-section of wing inboard of nacelles extended. Offset fighter canopy as in B. Mk. 8. Powered by new mark of Rolls-Royce Avon engine of unspecified output.

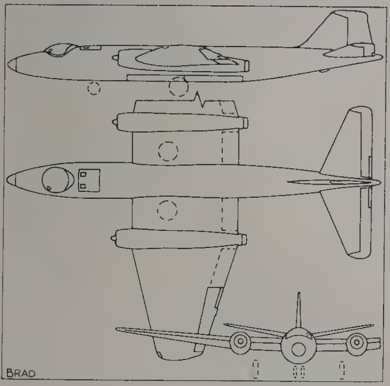
Canberra B. Mk. 20. Tactical bomber built in Australia by the Government Aircraft Factory, Fishermen's Bend, Melbourne, and modified to meet R.A.A.F. operational requirements. Powered by two Rolls-Royce Avon engines manufactured in Australia by Commonwealth Aircraft Corpn. First B. Mk. 20 flew for the first time on May 29, 1953. Mks. 21-24 reserved for further Australian developments.

TYPE.—High-altitude Medium Bomber.

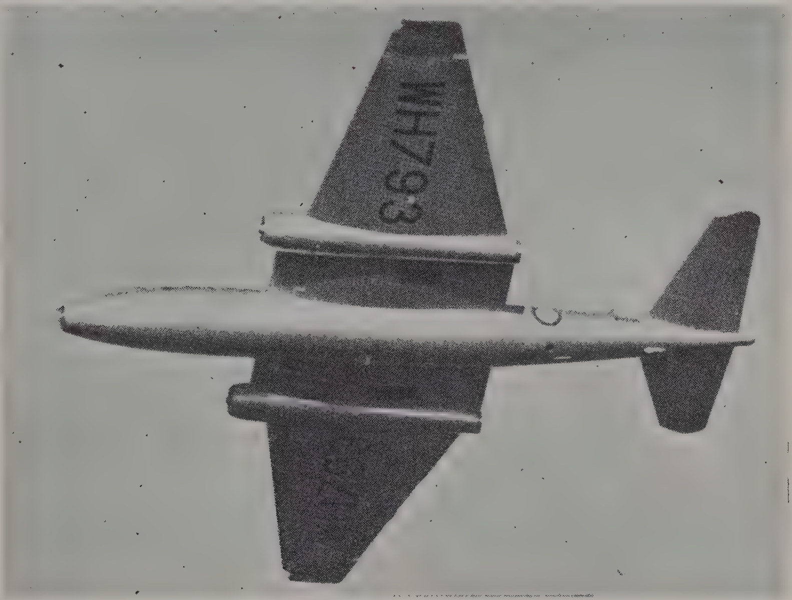
WINGS.—Cantilever mid-wing monoplane.

The English Electric Canberra T. Mk. 4 Dual-control Trainer (two Rolls-Royce Avon turbojet engines).

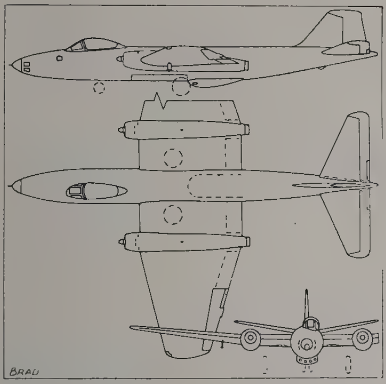
The English Electric Canberra B. Mk. 6 High-altitude Medium Bomber (two Rolls-Royce Avon turbojet engines).



The English Electric Canberra B. Mk. 6.



The English Electric Canberra P.R. Mk. 9.

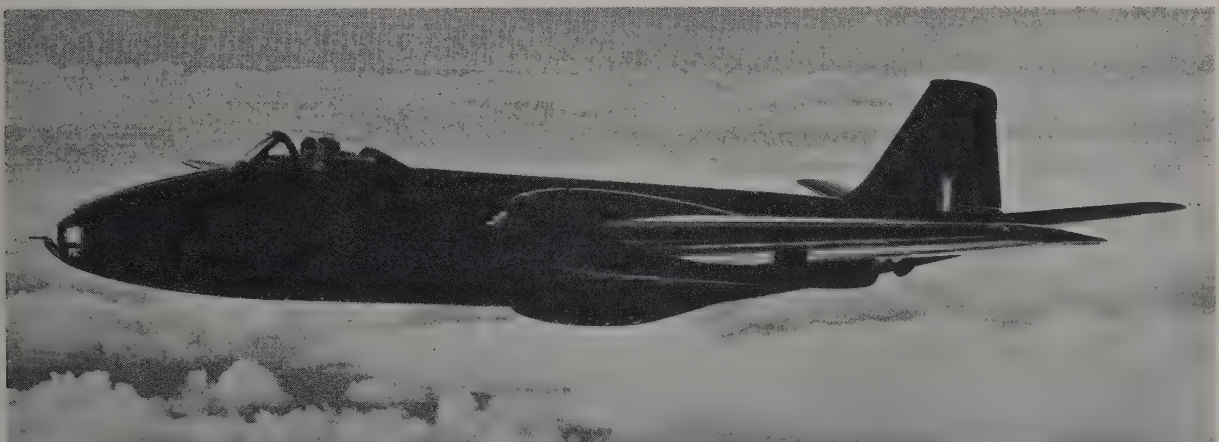


The English Electric Canberra B Mk. 8.

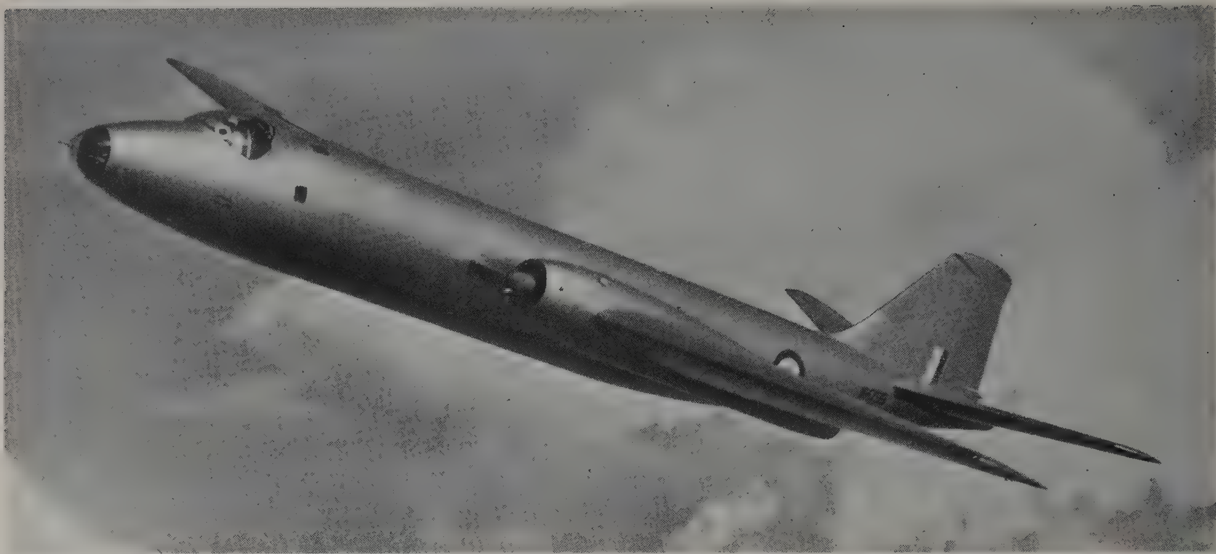
Symmetrical high-speed aerofoil. Dihedral, inner wing (to engine nacelle) 2°, outer wing 4° 21′. Root chord 19 ft. (5.8 m.). Tip chord 7 ft. 8 in. (2.34 m.). Sweepback on leading-edge (outer wing) 13 degrees, 53 minutes. Sweepforward on trailing-edge (outer wing) 19 degrees 53 minutes. All-metal single-spar structure with continuous main spar through fuselage. Irving-Westland pressure-balanced ailerons with spring-tabs in each. Four hydraulically-operated split trailing-edge flaps. "Finger-tip" type air brakes in top and bottom wing surfaces. Gross wing area 960 sq. ft. (89 m.²).

FUSELAGE.—All - metal semi - monocoque structure. Pressure bulkhead at rear of cockpit. Centre fuselage divided horizontally, with bomb-bay in lower compartment. Bomb doors, hydraulically-operated with remote selection, fitted with rollers which slide in curved tracks to retract into fuselage. All controls, pipe-lines and wires are jointed at the main fuselage transport joints to permit an easy break-down into major components. Maximum fuselage diameter 6 ft. (1.83 m.). Minimum ground clearance 2 ft. 0.25 in. (0.615 m.).

TAIL UNIT.—Cantilever monoplane tailplane



The English Electric Canberra B. Mk. 8 High-altitude Medium Bomber (two Rolls-Royce Avon turbojet engines).



The English Electric Canberra P.R. Mk. 7 Photographic Reconnaissance Monoplane.

with dihedral and single fin and rudder. All-metal structure. Variable incidence tailplane hinged at its leading-edge and operated by an English Electric actuator in the rear fuselage. Spring trim-tabs in port elevators. Mass-balanced rudder with spring trim-tabs. Tailplane span 27 ft. 4.9 in. (8.35 m.). Tailplane and elevator area 71.22 sq. ft. (6.62 m.^{2}). Tailplane centre-line chord 10 ft. (3.05 m.). Tailplane tip-chord 4 ft. (1.22 m.). Tailplane dihedral 10 degrees. Fin and rudder root chord (less dorsal fin) 12 ft. 8.5 in. (3.9 m.). Fin and rudder tip chord 5 ft. 0.55 in. (1.54 m.).

Landing Gear.—Retractable nose-wheel type. Each main unit, of English Electric design, is an oleo-pneumatic shock-absorber strut carrying a single wheel inboard on a cantilever stub axle. Dowty levered-suspension liquid-spring nose unit with twin wheels. Hydraulic retraction. Track 15 ft. 5 in. (4.7 m.).

Power Plant.—Two Rolls-Royce Avon axial-flow turbojet engines. Each engine carried in wing nacelle on four self-aligning mounting points, and completely accommodated forward of main spar, through which jet-pipe passes. Removable panels for installation of engine above and below nacelle, and servicing panel under forward end. Oil cooling radiator buried in wings outboard of nacelles. Flame detectors and a fire extinguishing system are fitted. Cartridge-fired turbine starter. Main fuel stowage in centre fuselage. Provision for auxiliary wing-tip tanks.

Accommodation (B. Mk. 2).—Crew of three, comprising pilot, navigator/plotter and observer, all provided with ejector seats. Pilot seated off-centre to port under large double-layer Perspex canopy, navigator further aft to starboard and observer behind pilot. Large crew escape hatch aft of canopy with two roof-lights. Transparent nose fairing with a visual sighting panel for the bomb-aimer. Cabin pressurisation by air supply from engine compressors. System operates automatically above 10,000 ft. (3,050 m.) and pressurizes to a differential of 3.5 lb./sq. in. (0.248 kg./m.^{2}). Emergency oxygen system. Crew entry through an upward-hingeing door in fuselage starboard side.

Dimensions.—
Span 63 ft. 11½ in. (19.5 m.).
Length 65 ft. 6 in. (20 m.).
Height over fin 15 ft. 7 in. (4.75 m.).

Weights and Performance.—
No data available.

FAIREY

THE FAIREY AVIATION CO., LTD.

Head Office: Hayes, Middlesex,
London Office: 24, Bruton Street, W.1.

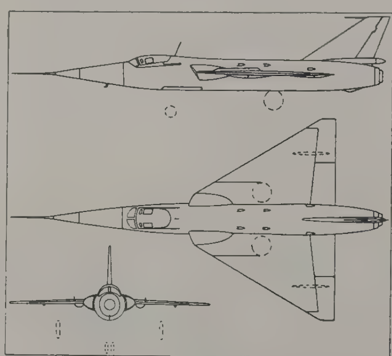
Works: Hayes, Middlesex; White Waltham, Near Maidenhead, Berks.; Stockport, Cheshire; Ringway Aerodrome, near Manchester; and Hamble, Hants.

Directors: Sir Richard Fairey, M.B.E., F.R.Ae.S. (Chairman and Managing Director), R. T. Outen (Deputy Chairman), L. Massey Hilton, D.F.C., A.F.C., A.F.R. Ae.S. and G. W. Hall, A.F.R.Ae.S. (Assistant Managing Directors), M. E. A. Wright, A.F.C., F.R.Ae.S., W. Broadbent, C. H. Chichester Smith, D.S.C. A.F.R. Ae.S. and R. Fairey (General Manager).

The Fairey Aviation Co., Ltd. has specialised on naval types for many years, although not to the exclusion of aircraft suitable for other purposes.

The principal production during 1954 concerned the Gannet A.S. Mk. 1 three-seat anti-submarine aircraft which is in service with the Royal Navy and has been ordered for the Royal Australian Navy. The Gannet T. Mk. 1 was in parallel production.

The small F.D. 1 delta-wing research monoplane which made its first flight on March 12, 1951, and has been described in previous editions, was joined in 1954



The Fairey F.D.1.

by the F.D. 2 which is capable of supersonic speed. Development of this aircraft continued during 1955.

The company has also received a contract for the construction of a prototype of a large rotary wing aircraft known as the Rotodyne. It will be powered by two Napier Eland turboprop engines, which will also be arranged to supply compressed air to combustion units located at the tips of the four-bladed rotor. The Rotodyne will have accommodation for 40 passengers or freight.

The Company's Research Division continues development work with various types of guided missiles. Some details of its research work with vertical take-off aircraft were released in 1953.

Other activities of the Fairey Company, conducted by its various subsidiary companies, include air survey and air photography, the development and manufacture of plastics, and the design and manufacture of light marine craft.

THE FAIREY F.D.2.

The Fairey Delta 2, or F.D. 2, which made its first flight on October 7, 1954, is a research aircraft which has been built,

The Fairey F.D.2 Delta-wing Research Monoplane (Rolls-Royce Avon engine).

The Fairey Gannet A.S. Mk. I Anti-submarine Monoplane (Armstrong Siddeley Double Mamba turboprop engine).

under a Ministry of Supply contract, to investigate the characteristics of flight and control at transonic and supersonic speed in level flight.

The F.D. 2 is a single-seat mid-wing delta design of all-metal construction and is powered by a Rolls-Royce Avon engine. The wing is of exceptionally thin section; nevertheless the main wheels of the tricycle landing-gear retract fully into the wing. The whole of the nose section of the fuselage can be, and is, lowered in flight by the pilot to provide him with a good forward view for take-off, landing and taxying. In normal flight the movable nose is aligned to the datum line of the aircraft.

At the time of writing no other details were available for publication.

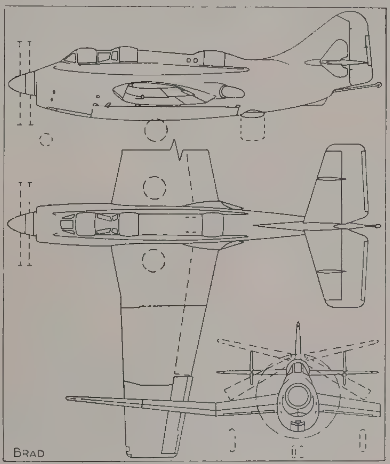
DIMENSIONS.—
Span 26 ft. 10 in. (8.18 m.).
Length 52 ft. 3 in. (15.94 m.).

THE FAIREY GANNET.

The Gannet is a three-seat anti-submarine aircraft which is now in service with the Royal Navy. It has also been ordered by the Royal Australian Navy.

The power-plant of the Gannet is an Armstrong Siddeley Double Mamba which develops 2,950 s.h.p. plus 810 lb. (368 kg.) s.t. for take-off. The Double Mamba consists basically of two Mamba engines placed side-by-side, each driving one of two co-axial contra-rotating airscrews. For long-range cruising one or other of the engines and its airscrew can be stopped and feathered, the full power of both engines being used mainly for take-off and for combat.

The Gannet is a mid-wing monoplane with a "cranked" wing, and has a retractable tricycle landing-gear and a triple-finned and single-ruddered tail-unit. The pilot is located well forward and has an outstandingly good view over the very short nose. A tail sting-type arrester hook and catapult points are fitted.



The Fairey Gannet A.S. Mk. I.

Wings are folded mechanically, the inner sections folding up and outer sections folding down simultaneously.

Two versions of the Gannet have so far been announced. These are :—

Gannet A.S. Mk. 1. Three-seat anti-submarine aircraft. Pilot in first cockpit, observer/navigator in second cockpit and radio/radar operator in third cockpit. Retractable radome beneath rear fuselage. Large fuselage bay for internal stowage of war load and provision for carrying variety of stores, including sono buoys, beneath wings.

Gannet T. Mk. 2. Operational training version of Mk. 1. Duplicated controls in first and second cockpits, with instructor in second. Main function is to provide advanced training in weapon and engine handling, but also to be adaptable for communications. Third cockpit can carry either radio operator or two passengers.

DIMENSIONS.—
Span 54 ft. 4 in. (16.56 m.).
Width (wings folded) 19 ft. 6 in. (5.94 m.).
Length 43 ft. (13.11 m.).
Height 13 ft. 8½ in. (4.18 m.).
Height (wings folded) 13 ft. 9 in. (4.19 m.).

WEIGHTS AND PERFORMANCE.—
No data available for publication.

THE FAIREY FIREFLY.

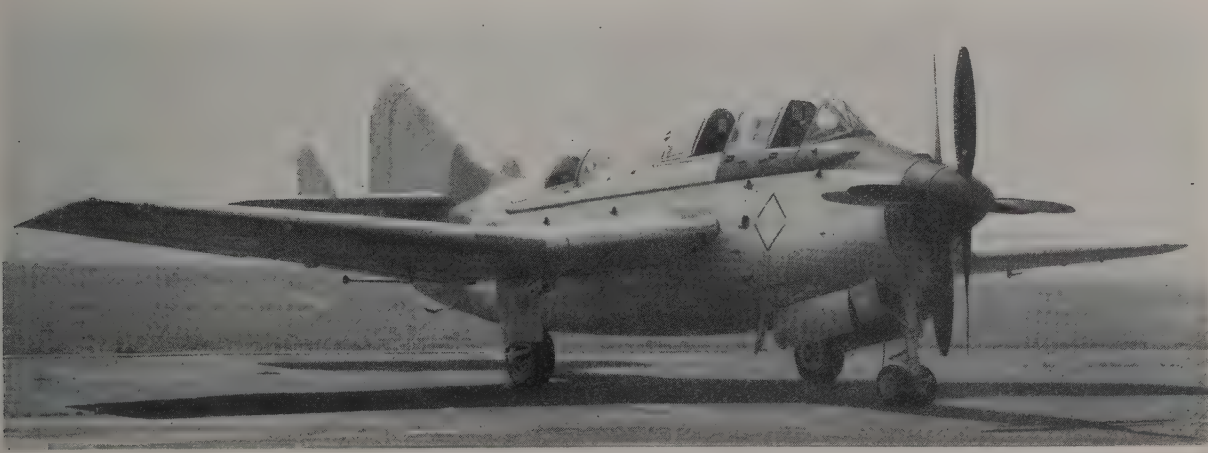
Production of the Firefly which in its prototype form first flew on December 22, 1941, was ended in 1955, but several versions remain in service with the Royal Navy and overseas.

The following versions of the Firefly have been built :—

Firefly Mk. 1. 1,990 h.p. Rolls-Royce Griffon 2 or 12 engine driving Rotol three-blade airscrew. First production version. Reconditioned Mk. 1's have been supplied to Ethiopia and Siam.

Firefly T. Mk. 1. Basically an F. Mk. 1 converted for use as a deck-landing conversion and instrument flying trainer. Rear cockpit, occupied by instructor, is 12 in. (30.5 cm.) above level of forward cockpit. Dual controls fitted.

Firefly T.T. Mk. 1. Developed from Mk. 1, this version is fitted for towing



The Fairey Gannet T. Mk. 2 Operational Trainer (Armstrong Siddeley Double Mamba turboprop engine).

The Fairey Firefly A.S. Mk. 6 Anti-submarine Monoplane (Rolls-Royce Griffon 74 engine).

glider, banner or sleeve targets for ground-to-air or air-to-air firing practice. A number of these target-tugs have been delivered to India, Sweden and Denmark.

Firefly T. Mk. 2. Armaments trainer. Similar to T. Mk. 1 with one 20 mm. cannon in each wing and gyro gunsight with separate ranging control in each cockpit. Provision for carriage of bombs and rockets, or long-range fuel tanks.

Firefly T. Mk. 3. Rolls-Royce Griffon 12 engine. A version of the F.R. Mk. 1 intended specifically to train observers. Otherwise similar to Mk. 1. It does not have the raised rear cockpit of the Firefly T. Mk. 1 and T. Mk. 2.

Firefly F.R. Mk. 4. Rolls-Royce Griffon 74 engine driving Rotol four-blade airscrew. Radiators moved from beneath nose to leading-edge extensions of centre-section. Wings reduced in span and given square tips. Increased fin area. Auxiliary fuel tank beneath port outer wing, and faired radome under starboard outer wing. Armament same as Mk. 1 but provision for various stores or long-range drop tanks on bomb pick-up points.

Firefly T.T. Mk. 4. Modified Mk. 4 with target-towing equipment for the Royal Navy.

Firefly Mk. 5. Rolls-Royce Griffon 74 engine. In three forms N.F., F.R. and A.S., all similar externally to Mk. 4. Supplied to the Royal Navy, the Royal Australian Navy and the Royal Canadian Navy.

Firefly T. Mk. 5. Deck-landing training version of the A.S. Mk. 5 engineered by the Fairey Aviation Company of Australasia Pty. Ltd. for the Royal Australian Navy. Raised rear cockpit as on T. Mk. 1.

Firefly A.S. Mk. 6. Anti-submarine aircraft. Structurally similar to the Mk. 5, but with different operational equipment and no armament.

Firefly T. Mk. 7. Rolls-Royce Griffon 5900 engine with "chin" radiator and driving four-blade airscrew. Three-seat unarmed anti-submarine trainer carrying radio and radar appropriate for latest detection devices, and sonobuoys for tracking a target at sea. New blister-enclosed rear cockpit accommodates two radar operators. Elliptical wings as on Mk. 1 but without wing radiators used in Mks. 4, 5 and 6. New tail-unit.

Firefly Mk. 8. Rolls-Royce Griffon 59 engine. Radio-controlled target drone developed from Mk. 7, for use in connection with guided missile test programme. May be flown normally or by remote-control from ground, through radio-controlled automatic pilot and electric actuators operating engine throttle, airscrew, flaps and arrester-hook. Cameras are installed in fairing at each wing-tip.

A full structural description of the Firefly has appeared in previous editions. The specification below applies to the T. Mk. 7.

DIMENSIONS.—
Span 44 ft. 6 in. (13.57 m.).
Length 38 ft. 3 in. (11.66 m.).
Height (tail down, one airscrew blade vertical) 13 ft. 2 in. (4.0 m.).

WEIGHTS AND LOADINGS.—
Weight empty 11,016 lb. (5,000 kg.).
Normal T.O. weight 13,970 lb. (6,342 kg.).
Wing loading 41 lb./sq. ft. (200 kg./m.^{2}).
Power loading 7.2 lb./h.p. (3.26 kg./h.p.).

PERFORMANCE.—
Max. speed 300 m.p.h. (480 km.h.) at 10,750 ft. (3,280 m.).

The Fairey Firefly T. Mk. 7 Trainer for Anti-submarine warfare (Rolls-Royce Griffon engine).

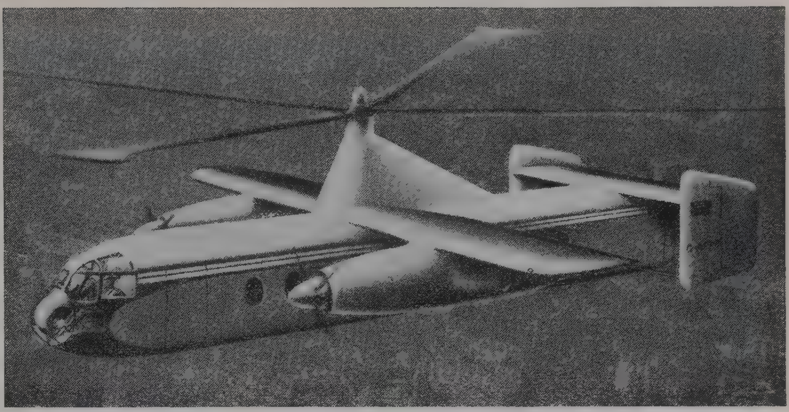
Cruising speed 257 m.p.h. (411 km.h.) at 13,500 ft. (4,120 m.).
Initial rate of climb 1,550 ft./min. (473 m./min.).
Service ceiling 25,500 ft. (7,780 m.).
Typical range 860 miles (1,376 km.) at 166 m.p.h. (266 km.h.) at 5,000 ft. (1,525 m.) at full load.

THE FAIREY ULTRA LIGHT HELICOPTER.

The Fairey Ultra Light Helicopter, which flew for the first time on August 14, 1955, is intended primarily for Army observation and liaison duties. The cabin, from which there is a 360 degree field of vision, seats two side-by-side, the pilot facing forward, while the observer may face either forward or aft.

A Blackburn-Turbomeca Palouste turbo-compressor supplies compressed air to pressure-jet units at the tips of the two-bladed rotor.

The helicopter can be transported on a standard Army 3-ton truck, and with porter bars inserted in the landing-gear cross-tubes can be lifted and moved manually.



An impression of the Fairey Rotodyne, a prototype of which is being built.

THE FAIREY ROTODYNE.

The Rotodyne, two prototypes of which have been ordered by the Ministry of Supply, will be a commercial vehicle capable of carrying 44 passengers or equivalent freight at speeds much higher than those of conventional helicopters. The general arrangement of the Rotodyne can be seen in the accompanying illustration.

The Rotodyne will be powered by two Napier Eland turboprop engines, of 3,150 s.h.p. each, which will also supply compressed air to the Fairey tip-mounted pressure-jet units. The four-blade rotor has a diameter of 90 ft. (27.45 m.).

For take-off most engine power is used to drive auxiliary compressors which supply air through hollow rotor blades to the tip jets, only a small proportion being diverted to the forward propellers for directional control. During cruising flight the auxiliary compressors are de-clutched and the rotor auto-rotates. Engine power is diverted to the two tractor airscrews, the fixed wings, of 47 ft. (14.33 m.) overall span, then contributing almost fifty per cent. of the lift.

The Rotodyne will have an unrestricted cabin space of 3,300 cub. ft. A variety of arrangements of the cabin will permit great flexibility of employment. The fuselage is unrestricted throughout its length and rear loading-doors for loading vehicles or heavy freight can be provided.

The Rotodyne will carry a maximum payload of 11,000 lb. (5,000 kg.) and will be able to maintain height at its maximum designed weight with one engine out irrespective of the forward speed at which engine failure occurs.

The economical cruising speed will be not less than 150 m.p.h. (240 km.h.) and the still air range will be approximately 250 nautical miles (460 km.).

FOLLAND
FOLLAND AIRCRAFT LTD.

Head Office and Works: Hamble, Southampton, Hampshire.

Chairman: C. L. Hill.

Directors: W. E. W. Petter, C.B.E., B.A., F.R.Ae.S. (Managing, and Chief Engineer), E. N. Egan, A.C.W.A. (Secretary), R. J. Norton, T. Gilbertson (General Manager), E. C. Lysaght, Sir Raymond Quilter, Bt.

This company was originally formed as British Marine Aircraft, Ltd., in August, 1935. This became a public company in February, 1936 and the change of name was made in December, 1937. The main factory is at Hamble and there are branch works at Eastleigh Airport, Chilbolton and elsewhere in the Southampton district.

During the last war, the company designed and produced the Folland 43/37 flying engine test-bed. It was also responsible for two other original types of its own design, the E.28/40 torpedo bomber and the F. 19/43 fighter, but changes in Government policy prevented both from being completed. During the same period the company also undertook sub-contract work on an extensive scale.

Since the war, its factories have been fully occupied with sub-contract work, which has included the large-scale production of wings for the de Havilland Vampire, Venom and Sea Venom and, more recently, tailplanes for the Hawker Hunter fighter and engine cowlings for the Bristol Britannia airliner. Another activity has been the development of a lightweight ejection seat from a basic design by the Swedish SAAB company.

In 1951, Folland started work on the design of a private-venture light fighter, the Gnat, under the direction of Mr. W. E. W. Petter, the company's Managing Director.

At first the company had the encouragement of the Air Ministry, but this lapsed when the development of the original engine around which the Gnat had been designed was abandoned. The company however, decided to alter the design sufficiently to take the lower-powered Armstrong Siddeley "long life" Viper engine in order to gain flight experience. To avoid confusion the Viper-powered prototype was named the Midge.

In November, 1953, the Bristol Aeroplane Company announced its intention to design and build the Orpheus engine and, following this, work on the Gnat was resumed. In the meantime the Midge was completed and flew for the first time on August 11, 1954.

Two Gnat Mk. 1 prototypes have been built and a small development order for the Gnat has been placed by the Ministry of Supply. The first Gnat prototype made its maiden flight on July 18, 1955.

THE FOLLAND Fo. 139 MIDGE.

The Midge, the low-powered prototype of the Gnat, was evolved by the adaptation of the original Gnat design to take a "long-life" version of the Armstrong Siddeley Viper engine, which was originally designed for short-life full-throttle operation in expendable aircraft. The Midge was built in order to obtain flight experience with the basic airframe while awaiting the advent of an engine of suitable characteristics to power the Gnat. The Midge, which flew for the first time on August 11, 1954, has undergone extensive flight trials, during which it has been dived at supersonic speed, although the Viper engine gives only 1,640 lb. (745 kg.) thrust, half the power of the Orpheus engine powering the Gnat.

The Midge originally had outboard manually-operated ailerons but it has subsequently been fitted with a Gnat wing of slightly larger span and provided with power-operated inboard ailerons.

The original Midge wing had a span of 20 ft. 8 in. (6.30 m.), an aspect ratio of 3.25 and a gross area of 125 sq. ft. (11.61 m.^{2}).

Dimensions.—
Span 20 ft. 8 in. (6.30 m.).
Length 27 ft. 9 in. (8.46 m.).
Height 8 ft. 9 in. (2.66 m.).

Weight Loaded.—
4,900 lb. (2,225 kg.).

The Folland Gnat Light Fighter (left) and the Midge low-powered prototype.

The Folland Midge (Armstrong Siddeley Viper turbojet engine), the low-powered prototype of the Gnat.

PERFORMANCE (Viper engine—1,640 lb.= 745 kg. s.t.).—
Max. speed at S/L. 550 m.p.h. (880 km.h.).
Absolute ceiling 40,000 ft. (12,200 m.).
Landing run (without braking parachute) 750-1,000 yds. (686-915 m.).
Landing run (with braking parachute and wheel brakes) 450 yds. (412 m.).

THE FOLLAND Fo. 141 GNAT.

The Gnat Mk. 1 lightweight fighter has approximately one-third of the weight, is roughly half the size and commands less than half the thrust of a standard jet fighter. It is claimed that twenty-five Gnat airframes can be built in the man-hours required to make five standard airframes and that, fully-equipped, a Gnat costs but a third or a quarter of the price of a standard fighter and can be built without the use of large and costly machine tools.

Performance details cannot be given but it has been stated that the Gnat Mk. 1 will have a high sub-sonic speed in level flight and that later versions will be supersonic in level flight. All versions will have an exceptionally good rate of climb and small turning radius. The service ceiling will be in excess of 50,000 ft. (15,250 m.) and the duration more than one hour on internal tanks.

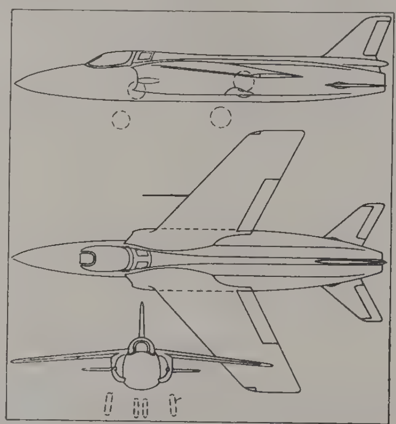
TYPE.—Single-seat lightweight Fighter or Fighter-Bomber.

WINGS.—Shoulder-wing cantilever swept-wing monoplane. Angle of sweepback 40°. Chord (mean) 6 ft. 2 in. (1.87 m.). Thickness/chord ratio 0.08. Aspect ratio 3.25. Anhedral 5°. One-piece wing of conventional light alloy construction fits in recess in top of fuselage and secured by bolts at four main points. Power-operated large-area inboard ailerons. Ailerons droop to serve as flaps. Gross wing area 136.6 sq. ft. (12.69 m.²).

FUSELAGE.—Light alloy semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Variable-incidence tailplane. Elevators, which act as servos, linked to hydraulic jack which in turn moves tailplane. Vertical area 14 sq. ft. (1.30 m.²). Horizontal area 18 sq. ft. (1.66 m.²). Span of tail 9 ft. (2.74 m.).

LANDING GEAR.—Retractable nose-wheel type, all wheels retracting into fuselage. Messier shock-absorber struts. Wheel well fairings attached to individual landing-gear units and serve as air-brakes when landing-gear is partly lowered, the relative movements of the air brakes being so adjusted that no change of trim occurs at any speed. A stop on landing-gear air brake selector prevents gear from being fully lowered when braking is desired. Toe-operated Dunlop disc wheel brakes. Main wheel tyres 20 × 5.25, nose wheel tyres (twin) 17 × 3.5. Wheelbase 7 ft. 9 in. (2.36 m.). Track 5 ft. 1 in. (1.55 m.).



The Folland Gnat.

POWER PLANT.—One Bristol BE.26 Orpheus axial-flow turbojet engine. Air intakes in sides of fuselage. All fuel in fuselage with common collector tank and one booster pump. To provide ferrying range tip tanks can be fitted. Compressed-air starting, air bottles being filled by two-stage petrol engine-driven compressor.

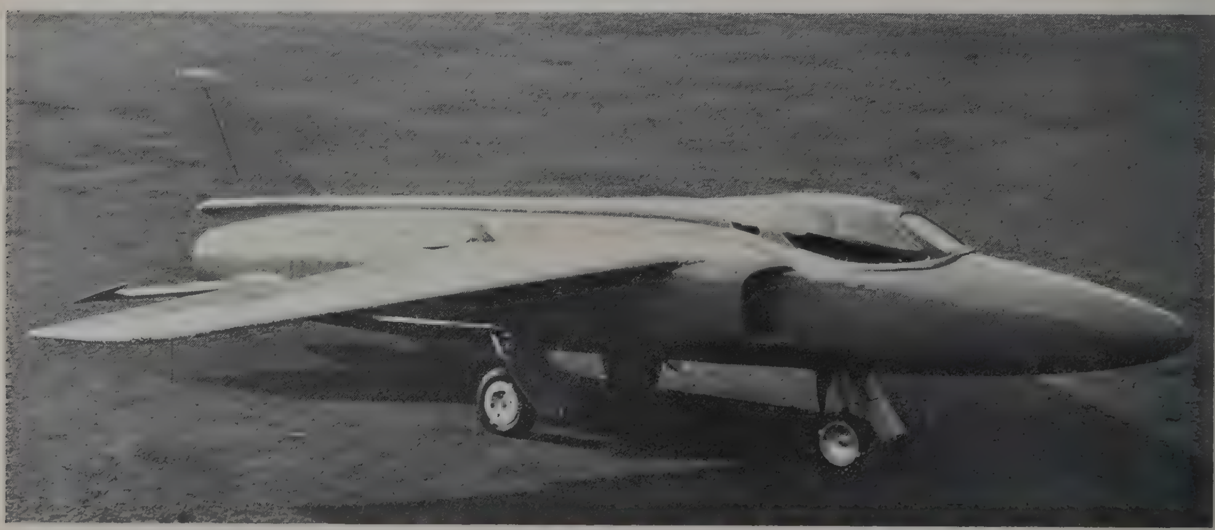
ACCOMMODATION.—Single-seat pressurised cockpit with jettisonable canopy. Folland-Saab lightweight automatic ejector seat. Standard cockpit instrumentation.

ARMAMENT.—Two 30 mm. Aden cannon with their barrels in the air intake fairings, one on each side of fuselage. Provision for underwing mounting of two 500-lb. (227-kg.) bombs or twelve 3-inch (7.6-cm.) rocket projectiles.

EQUIPMENT.—VHF radio and standby set, gyro gun-sight and radar ranging, supplementary oxygen supply, braking parachute, etc. If required UHF radio can be fitted.

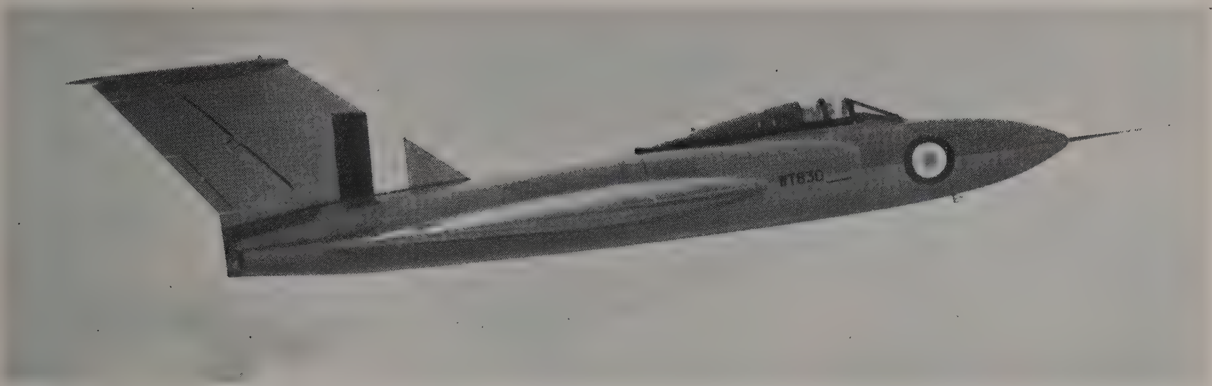
DIMENSIONS.—
Span 22 ft. 2 in. (6.75 m.).
Length 27 ft. 9 in. (8.46 m.).
Height 8 ft. 9 in. (2.66 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The Folland Gnat Mk. I Lightweight Fighter (Bristol Orpheus turbojet engine).

GLOSTER



The fourth prototype Gloster Javelin Two-seat All-weather Fighter (two Armstrong Siddeley Sapphire turbojet engines).

GLOSTER AIRCRAFT CO. LTD.

Head Office, Works and Aerodrome: Gloucester.

Directors: Sir Frank Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman); Sir Thomas Sopwith, C.B.E., F.R.Ae.S.; H. Burroughes, F.R.Ae.S.; P. G. Crabbe, F.R.Ae.S., M.I.P.E. (Managing Director); R. V. Atkinson (Works Director); R. W. Walker, F.R.Ae.S. (Director and Chief Designer) and E. W. Shambrook, F.C.I.S. (Secretary).

The Gloster Aircraft Co., Ltd., which now forms part of the Hawker Siddeley Group, was formed in 1915 and since then has specialised mainly in the production of high-performance military aircraft.

To the Gloster company belongs the distinction of being the first aircraft manufacturer in either Great Britain or the United States to design, build and fly an aircraft propelled by a gas-turbine jet engine. From the experience gained in the design, construction and flight testing of the two E.28/39 prototypes, the first of which flew on May 15, 1941, the Gloster company designed and put into production the Meteor single-seat twin-jet fighter.

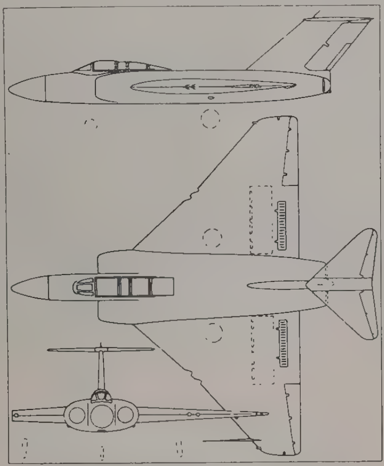
The Meteor, in various marks, has been in service in the R.A.F. since 1943. It has also been supplied to many foreign air forces, including those of the Argentine Republic, Australia, Belgium, Brazil, Denmark, Egypt, France, Holland, Israel and Syria. The Meteor was phased out of production in 1954.

In June, 1952, the Javelin two-seat twin-engined delta-wing all-weather fighter was ordered into super-priority production for the Royal Air Force under the designation Javelin F (AW) Mk. 1.

Over and above its normal production commitments, the Company is engaged in a very extensive development and research programme.

THE GLOSTER G.47 JAVELIN.

The Javelin was the first twin-engined delta-wing aircraft and the first in Britain to be designed for a specific operational rôle—that of an All-weather Fighter. Five prototypes of the Javelin have been built, the first flying for the first time on November 26, 1951. The first production Javelin F (AW) Mk. 1 flew on July 22, 1954.



The Gloster Javelin F. (A.W.) Mk. I.

The only details of the Javelin which were available for publication at the time of going to press follow.

Type.—Two-seat All-weather Fighter.

Wings.—Mid-wing monoplane of Delta configuration. 39° leading-edge sweepback. All-metal stressed-skin structure. Power-boosted all-metal ailerons. Hydraulically-operated all-metal flaps and dive-brakes.

Fuselage.—All-metal stressed-skin structure.

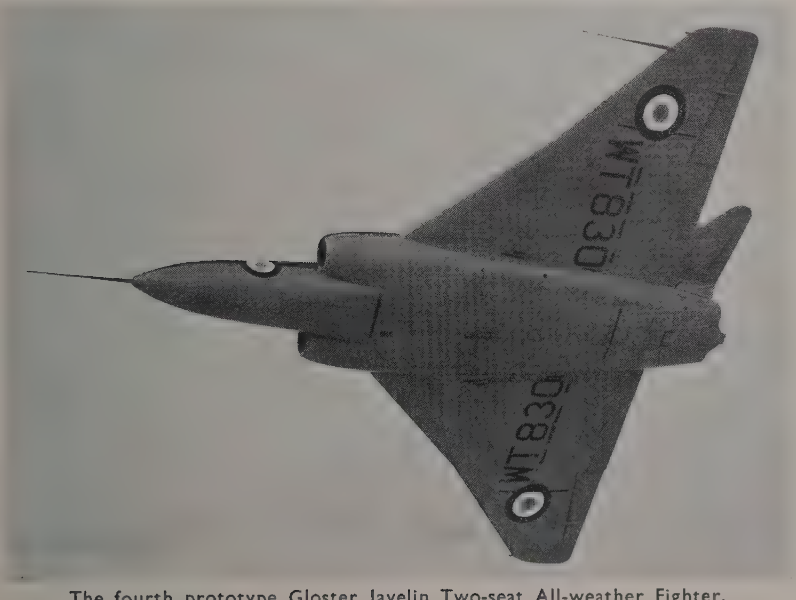
Tail Unit.—All surfaces swept-back. Variable-incidence delta tailplane at top of fin. All-metal stressed-skin structure. Tailplane span 15 ft. (4.57 m.).

Landing Gear.—Retractable nose-wheel type. Hydraulic actuation. Dowty liquid-spring shock-absorber. Dunlop wheels. Lockheed hydraulic disc brakes.

Power Plant.—Two Armstrong Siddeley Sapphire turbojet engines (8,300 lb. = 3,770 kg. s.t. each) in nacelles on sides of fuselage.

Accommodation.—Crew of two, pilot and radar-operator, in tandem in pressurised cockpit. Martin-Baker ejection seats.

Dimensions.—
Span 52 ft. (15.86 m.).
Length 57 ft. (17.38 m.).
Height 17 ft. (5.18 m.).



The fourth prototype Gloster Javelin Two-seat All-weather Fighter.

THE GLOSTER G.41 METEOR.

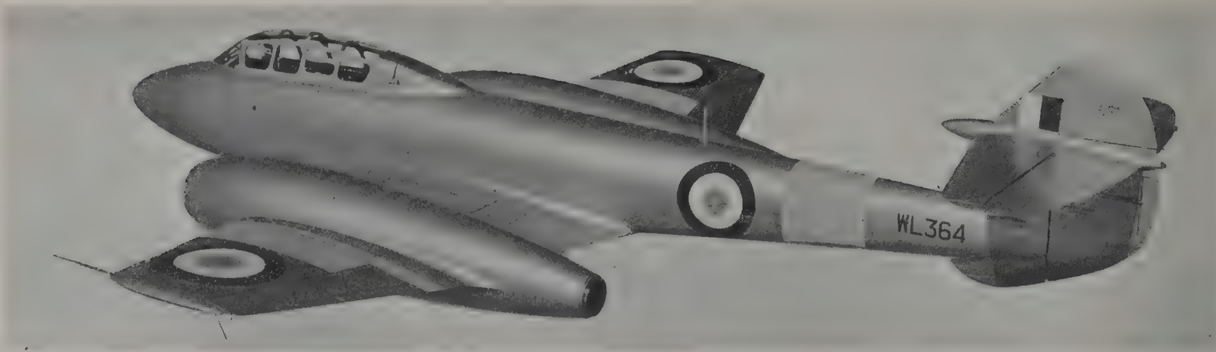
The following versions of the Meteor are still in service in the Royal Air Force and in certain foreign air forces (Mks. 7 and 8). Details of earlier versions of the Meteor have appeared in previous editions of "All the World's Aircraft."

Meteor T. Mk. 7. Two-seat Trainer. Pupil and instructor in tandem cockpits under continuous canopy which hinges to starboard to give access to both seats. Complete dual controls. No armament or military load. First T. Mk. 7 flew on March 19, 1948.

Meteor F. Mk. 8. Two Rolls-Royce Derwent 8 turbojet engines (3,500 lb. = 1,585 kg. s.t. each). The last fighter version. Armament consists of four 20 mm. cannon (195 r.p.g.). First Mk. 8 flew on October 12, 1948. Phased out of production in 1954.

Meteor F.R. Mk. 9. Fighter-reconnaissance version of the Mk. 8. Provision in nose for carrying the necessary camera and equipment, and nose fairing modified to include a front downward-facing and side oblique photographic windows. The standard armament of four cannon in the nose is retained. Length 43 ft. 6 in. (13.25 m.). First Mk. 9 flew on March 23, 1950.

Meteor P.R. Mk. 10. Unarmed version for high altitude reconnaissance. Has early Mk. 3 type long-span wings and Mk. 4 type tailplane. In other respects this mark retains the features of the Mk. 8. The camera-carrying nose is similar to that of the Mk. 9, and in addition provision is made for a vertical camera in the rear fuselage. Span 43 ft. 0 in. (13.1 m.). Length 44 ft. 3 in. (13.5 m.). First Mk. 10 flew on March 29, 1950.



The Gloster Meteor T. Mk. 7 Trainer (two Rolls-Royce Derwent turbojet engines).

Meteor N.F. Mks. 11, 12, 13 and 14. Two-seat Night Fighters, the design and production of which have been the responsibility of Sir W. G. Armstrong Whitworth Aircraft Ltd. For further details see under "Armstrong Whitworth."

A full structural description of the Meteor has appeared in previous editions of "All the World's Aircraft." Weights and performance details of the Mks. 7, 8, 9 and 10 follow.

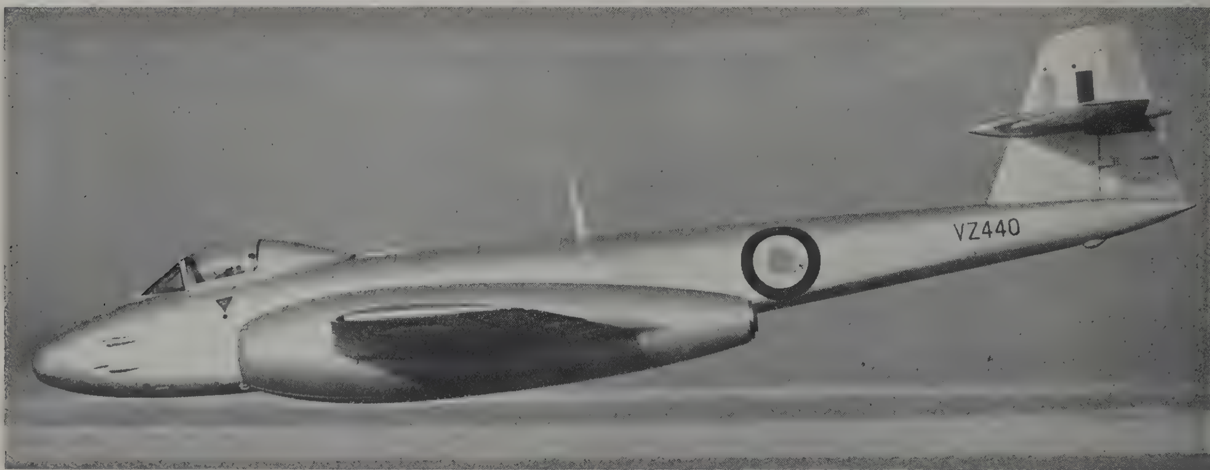
Weight loaded (with ventral and under-wing tanks) 19,000 lb. (8,636 kg.).

WEIGHTS (F.R. Mk. 9).—
Weight empty 10,790 lb. (4,893 kg.).
Weight loaded (internal fuel) 15,770 lb. (7,152 kg.).
Weight loaded (ventral tank) 17,350 lb. (7,867 kg.).
Weight loaded (ventral and wing drop tanks) 19,135 lb. (8,679 kg.).

WEIGHTS (P.R. Mk. 10).—
Weight empty 10,993 lb. (4,988 kg.).
Weight loaded (internal fuel) 15,400 lb. (6,987 kg.).

Total distance to clear 50 ft. (15.25 m.) in take-off 785 yds. (720 m.).
Total landing distance from 50 ft. (15.25 m.) 935 yds. (850 m.).

PERFORMANCE (F. Mk. 8 at 15,675 lb. = 7,109 kg. A.U.W.).—
*Max. speed at S.L. 592 m.p.h. (956 km.h.).
Max. speed at 20,000 ft. (6,100 m.) 575 m.p.h. (927 km.h.).
Max. speed at 40,000 ft. (12,200 m.) 534 m.p.h. (860 km.h.).
Max. continuous cruise at 20,000 ft. 414 m.p.h. (667 km.h.).



The Gloster Meteor F. Mk. 8 Single-seat Fighter (two Rolls-Royce Derwent turbojet engines).

DIMENSIONS (F. Mk. 8).—
Span 37 ft. 2 in. (11.3 m.).
Length 43 ft. 6 in. (13.2 m.).
Height (over tail) 13 ft. 10 in. (3.96 m.).
Engine centres 15 ft. 4 in. (4.67 m.).

WEIGHTS.—(T. Mk. 7.).
Weight empty 10,540 lb. (4,780 kg.).
Weight loaded 14,140 lb. (6,410 kg.).

WEIGHTS (F. Mk. 8).—
Weight empty 10,626 lb. (4,820 kg.).
Weight loaded (internal fuel only) 15,675 lb. (7,109 kg.).
Weight loaded (with ventral drop tank) 17,250 lb. (7,824 kg.).
Weight loaded (ventral tank) 16,975 lb. (7,702 kg.).
Weight loaded (ventral and wing drop tanks) 18,765 lb. (8,515 kg.).

PERFORMANCE (T. Mk. 7) at 14,140 lb. (6,410 kg.) loaded weight).—
Speeds from sea level to 40,000 ft. (12,190 m.) same as F. Mk. 4.
Rate of climb at sea level 8,000 ft./min. (2,440 m./min.).
Range at 30,000 ft. (9,150 m.) with normal internal fuel (325 Imp. gallons = 1,480 litres) 470 miles (752 km.).

Max. continuous cruise at 40,000 ft. 270 m.p.h. (435 km.h.).
Rate of climb at S.L. 7,000 ft./min. (35.5 m./sec.).
Service ceiling 44,000 ft. (13,410 m.).
Range (still air) at 20,000 ft. 520 miles (840 km.).
Range (still air) at 40,000 ft. 710 miles (1,143 km.).
Take-off run 1,450 ft. (440 m.).
Landing run 1,500 ft. (455 m.).
**Max. permissible Mach. No.*—0.82 (*true*).

PERFORMANCE (F.R. Mk. 9 at 15,770 lb. = 7,152 kg. A.U.W.).—

The Gloster Meteor F.R. Mk. 9 Fighter-Reconnaissance Monoplane (two Rolls-Royce Derwent turbojet engines).
(J. D. R. Rawlings).

Same as for Mk. 8 at 15,675 lb.=7,109 kg.

Performance (P.R. Mk. 10 at 15,400 lb.= 6,987 kg. A.U.W.).—

Max. speed at S./L. 500 m.p.h. (806 km.h.).

Speed at 10,000 ft. (3,050 m.) 574 m.p.h. (927 km.h.).

Speed at 20,000 ft. (6,100 m.) 551 m.p.h. (890 km.h.).

Speed at 40,000 ft. (12,190 m.) 529 m.p.h. (852 km.h.).

Climbs and Ranges (P.R. Mk. 10 at 17,345 lb.=7,867 kg. A.U.W.).

Rate of climb at S/L. 6,050 ft./min. (30.7 m./sec.).

Service ceiling 47,000 ft. (14,330 m.).

Range at 20,000 ft. (6,100 m.) 752 miles (1,214 km.).

Range at 40,000 ft. (12,190 m.) 1,090 miles (1,760 km.).

Ranges (P.R. Mk. 10 at 18,765 lb.=8,514 kg. A.U.W.).—

Range at 20,000 ft. (6,100 m.) 955 miles (1,538 km.).

Range at 40,000 ft. (12,190 m.) 1,140 miles (1,844 km.).

HANDLEY PAGE

The Handley Page Victor Bomber (four Armstrong Siddeley Sapphire turbojet engines).

HANDLEY PAGE, LTD.

Head Office and Works: Cricklewood, London, N.W.2.

Aerodrome: Colney Street, Radlett, Hertfordshire.

HANDLEY PAGE (READING) LTD.

Registered Office: Cricklewood, London, N.W.2.

Works: Woodley, near Reading, Berks.

Directors: Sir Frederick Handley Page, C.B.E. (Chairman and Managing Director), Air Cdre. A. Vere Harvey, C.B.E., M.P. (Deputy Chairman), G. C. D. Russell, A.F.R.Ae.S. (Assistant Managing Director), A. A. Lough, F.C.A., F. S. Gaylor.

Director, Technical Department: R. S. Stafford, F.R.Ae.S.

Chief Designer (Handley Page, Ltd.): C. F. Joy, F.R.Ae.S.

Chief Designer (Handley Page (Reading) Ltd.): E. Gray, B.Sc., M.I.Mech.E., A.F.R.Ae.S.

Secretary: J. H. S. Green, A.C.A.

Handley Page, Ltd., has been associated with flying in all its aspects since June 17, 1909. It thus possesses the proud distinction of being the first limited company incorporated in Great Britain for the purpose of manufacturing aircraft.

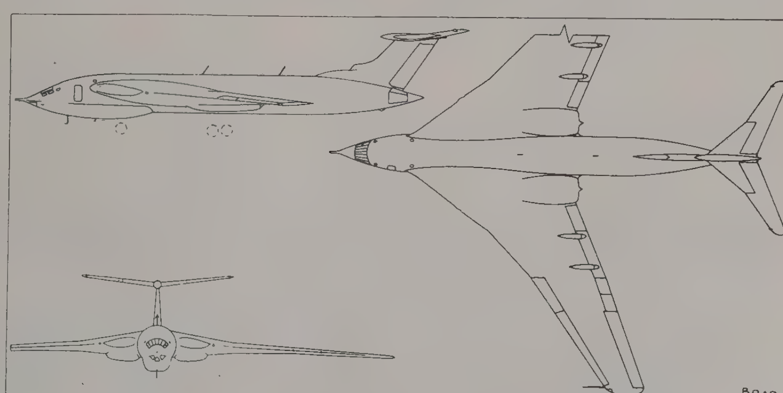
The latest product of Handley Page, Ltd. is the "crescent-wing" Victor bomber, which is in production for the Royal Air Force.

Handley Page (Reading), Ltd. was formed in June, 1948, when Handley Page, Ltd. took over Miles Aircraft, Ltd. At the same time it acquired the production rights of the Miles Marathon feeder-line transport, which was put into production as the Handley Page Marathon.

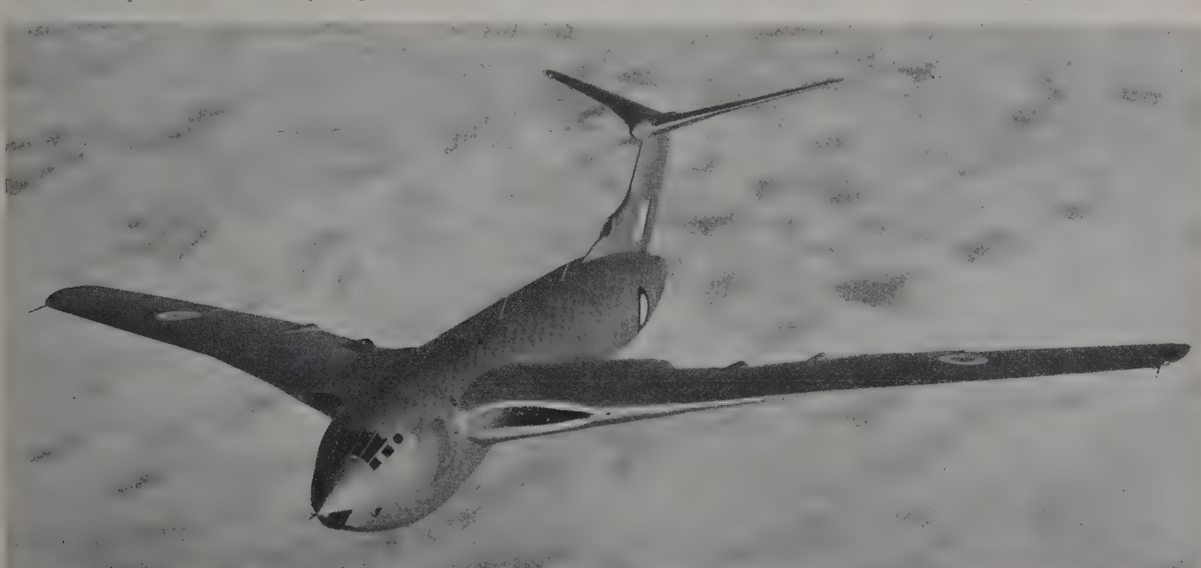
The latest Handley Page (Reading) design is the H.P.R.3 Herald, a four-engined medium-range civil transport.

THE HANDLEY PAGE H.P.80 VICTOR.

The Victor four-jet bomber employs the so-called "crescent wing" in which



The Handley Page Victor Four-engined "Crescent-wing" Bomber.



The Handley Page Victor Bomber (four Armstrong Siddeley Sapphire turbojet engines).

the angle of sweep of each wing is progressively decreased from root to tip, with the outer sections only slightly swept.

This configuration was evolved to meet the demands of a specification which called not only for operation at high sub-sonic speeds at altitude over very long ranges, but also good control over the whole speed range, particularly at the approach and landing.

At the time of writing security restrictions did not permit the publication of any details of the Victor beyond the fact that it is powered by four Armstrong Siddeley Sapphire turbojet engines.

In 1955 the Under Secretary of State for Air revealed that the Victor has flown to within a small fraction of the speed of sound at an altitude of over 50,000 ft. (15,250 m.).

Dimensions (approx.).—
Span 110 ft. (33.5 m.).
Length 114 ft. 11 in. (35.0 m.).
Height 26 ft. 9 in. (8.1 m.).

THE HANDLEY PAGE HASTINGS.

The Hastings is a general purpose long-range transport which is in service in the Royal Air Force and the Royal New Zealand Air Force. Its rôles include those of (*a*) freighter, accommodating bull-dozers, 25-pdr. anti-tank guns and 3-ton tanks; (*b*) paratroop transport, carrying 30 paratroops and 20 supply containers; (*c*) ambulance, accommodating 32 stretcher and 28 sitting cases, four attendants and one ton of medical supplies; (*d*) troop-carrier, with provision for 50 fully equipped airborne troops; (*e*) supply dropper, when a typical load would be twenty-four 350 lb. (160 kg.) panniers and twenty 400 lb. (182 kg.) containers; (*f*) jeep carrier, with a jeep or anti-tank gun on a carrier fitted beneath the fuselage; and (*g*) glider tug.

The following are the production versions of the Hastings:—

Hastings C. Mk. 1. Four Bristol Hercules 101 engines. Initial production version. First production C. Mk. 1 flew on April 25, 1947. Tailplane mounted above centre-line of fuselage. Original total internal fuel capacity 2,560 Imp. gallons (11,650 litres). All Mk. 1's have now been modified to Mk. 2 standard, including provision for extra tankage, and are now known as C. Mk. 1A.

Hastings Met. Mk. 1. Specially equipped version of the C. Mk. 1 for long-range meteorological reconnaissance.

Hastings C. Mk. 2. Four Bristol Hercules 106 engines. Tailplane lowered to centre-line of fuselage and increased in area to 442 sq. ft. (41.1 m.^{2}); spring-tabs fitted in elevators. Extra fuel tanks in outer wings increase total tankage to 3,172 Imp. gallons (14,420 litres). Crew rest station replaced by air quartermaster post. Max. payload increased to 20,311 lb. (9,221 kg.). First production C. Mk. 2 flew on November 14, 1950.

Hastings C. Mk. 3. Four Bristol Hercules 737 engines, with single-stage blowers. Basically similar to the C. Mk. 2 apart from engine change. Four supplied to the Royal New Zealand Air Force. First C. Mk. 3 flew on November 3, 1952.

Hastings C. Mk. 4. V.I.P. version of C. Mk. 2. De luxe accommodation for four V.I.P.'s and staff. All seats face aft. Four delivered to R.A.F. Transport Command. First C. Mk. 4 made its first flight on September 22, 1951.

The description and specification which follow refer to the C. Mk. 2; the other Marks are structurally similar.

Type.—Four-engined Military Transport.

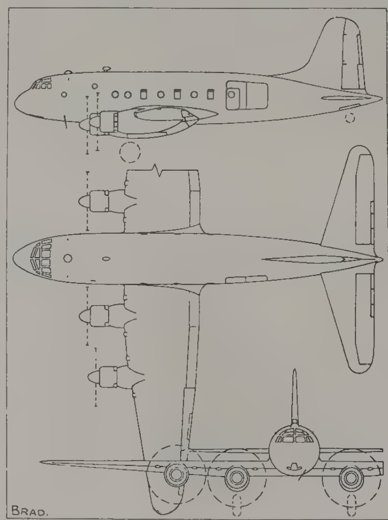
Wings.—Cantilever low-wing monoplane. Aerofoil section NACA 23021 at root tapering to NACA 23007 at tip. Aspect ratio 9.08. Root chord 16 ft. (4.88 m.), tip chord 5 ft. 10 in. (1.78 m.). Incidence 2°. All-metal two spar structure. T.K.S. de-icing on leading-edges. Mass-balanced Frise-type ailerons on outer wings. Spring-tab in each aileron, and trim-tab in starboard. All-metal hydraulically-operated trailing-edge flaps in two sections each side between ailerons and fuselage. Total aileron area 196 sq. ft. (18.26 m.^{2}). Total flap area 217 sq. ft. (10.08 m.^{2}). Gross wing area 1,408 sq. ft. (130.8 m.^{2}).

Fuselage.—All-metal structure of circular cross-section. Max. external diameter 11 ft. (3.35 m.).

Tail Unit.—All-metal cantilever monoplane type. T.K.S. de-icing to tailplane and fin. Spring-tab and trim-tab in each movable surface. Gross tailplane and elevator area 442 sq. ft. (41.1 m.^{2}); total elevator area 143 sq. ft. (13.3 m.^{2}). Rudder area 64.5 sq. ft. (6 m.^{2}).

Landing Gear.—Retractable tail-wheel type. Electro-Hydraulics main landing-gear units each with two oleo-pneumatic shock-absorber struts. Hydraulic retraction. Track 24 ft. 8 in. (7.52 m.).

Power Plant.—Four 1,675 h.p. Bristol Hercules 106 fourteen-cylinder two-row radial sleeve-valve air-cooled engines. Rotol cooling fan in front of engine. D.H. four-blade constant-speed full-feathering metal airscrew, 13 ft. (3.96 m.) diameter. Riveted sheet alloy and bag type fuel tanks in wings, with total capacity of 3,172 Imp. gallons (14,420 litres). Four oil tanks, each of 35 Imp. gallons (159 litres) capacity.



The Handley Page Hastings C. Mk. 2.

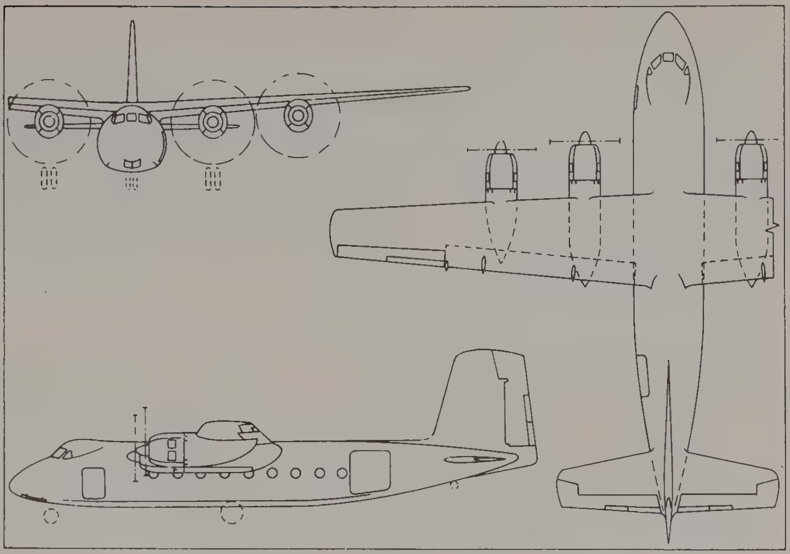
The Handley Page Hastings C. Mk. 2 Transport (four 1,675 h.p. Bristol Hercules 106 engines).

Accommodation. — Flight compartment accommodates pilot (on port) and co-pilot side-by-side with dual controls; radio-operator, navigator and flight engineer. Crew entry hatch under nose. Entire fuselage space from crew compartment to rear bulkhead is available for freight. Max. internal diameter 10 ft. 4 in. (3.15 m.); max. height 7 ft. 3 in. (2.21 m.). Freight-loading door 9 ft. 5 in. wide × 5 ft. 9 in. high (2.84 m. × 1.75 m.) at rear on port side. This incorporates a paratroop door and another is fitted on starboard side. Reinforced floor with built-in channels fore-and-aft and lashing points and fittings. Walls soundproofed and lined with plywood up to 2 ft. (0.61 m.) from floor. Light-weight air-transportable ramp for loading wheeled vehicles and freight. Hand or power-operated Gyral winch at forward end of hold. Provision can be made for 30 paratroops, with supplies; 32 stretchers plus 28 sitting wounded: 50 fully-equipped troops; or various combinations of military freight. Two lavatories with wash-basins and running water at rear of main cabin. Entire accommodation heated and air-conditioned. Full oxygen equipment for crew together with 35 oxygen points in main cabin. Three emergency exits in flight compartment and six in main cabin.

Dimensions.—
- Span 113 ft. (34.46 m.).
- Length 81 ft. 8 in. (24.9 m.).
- Height 22 ft. 6 in. (6.86 m.).

Weights.—
- Basic equipped weight (freighter) 48,427 lb. (21,986 kg.).
- Max. payload 20,311 lb. (9,221 kg.).
- Payload 10,000 lb. (4,585 kg.) for 3,000 mile (4,827 km.) range.
- Max. take-off weight 80,000 lb. (36,320 kg.).
- Max. landing weight 74,000 lb. (33,570 kg.).

Performance.—
- Max. speed 348 m.p.h. (560 km.h.) at 22,200 ft. (6,770 m.).
- Max. weak mixture cruising speeds 291 m.p.h. (468 km.h.) at 15,200 ft. (4,630 m.) and 302 m.p.h. (486 km.h.) at 23,600 ft. (7,190 m.).
- Initial rate of climb 890 ft./min. (272 m./min.).
- Climb to 20,000 ft. (6,100 m.) 26 minutes.
- Service ceiling 26,500 ft. (8,077 m.).
- Range with max. payload 1,690 miles (2,720 km.).
- Max. range 4,250 miles (6,850 km.).
- Take-off distance to 50 ft. (15.2 m.) 1,586 yds. (1,450 m.).
- Landing distance from 50 ft. (15.2 m.) 1,430 yds. (1,308 m.).



The Handley Page Herald General Purposes Transport.

THE HANDLEY PAGE H.P.R.3 HERALD.

The Herald, which originates from the Handley Page (Reading) design department, is a four-engined pressurised high-wing civil transport which has been designed to operate from primitive air-fields under a wide range of climatic conditions.

At the time of writing twenty-nine Heralds were on order. They will be operated by Queensland Airlines, Australian National Airways and Lloyd Aéreo Colombiano. The prototype Herald flew for the first time on August 25, 1955.

Type.—Four-engined medium-range Feeder-line or General Purpose Transport.

Wings.—High-wing cantilever monoplane. Dihedral 4°. Chord 12 ft. 6 in. (3.81 m.) at root, 6 ft. 3 in. (1.91 m.) at tip. Two-spar all-metal stressed-skin structure. Slotted flaps inboard of ailerons. Thermal de-icing.

Fuselage.—All-metal stressed-skin structure.

Tail Unit.—Cantilever monoplane type with single fin and rudder. All-metal structure. Thermal de-icing. Span of tail 29 ft. (8.84 m.).

Landing Gear.—Retractable nose-wheel type. Hydraulic actuation. Main units retract forward into inboard engine nacelles. All units have twin wheels and low-pressure tyres. Hydraulic disc-type wheel brakes on main units. Wheelbase 24 ft. 8 in. (7.52 m.). Track (between centre-lines of oleo legs) 22 ft. (6.71 m.).

Power Plant.—Four 870 h.p. Alvis Leonides Major fourteen-cylinder two-row radial air-cooled engines in nacelles underslung from the wing and enclosed in four-section "petal" cowlings. Three-blade constant-speed airscrews 11 ft. (3.35 m.) diameter. Two fuel tanks (350 Imp. gallons = 1,590 litres each) in wings, one on each side of fuselage. Oil tank in each engine nacelle.

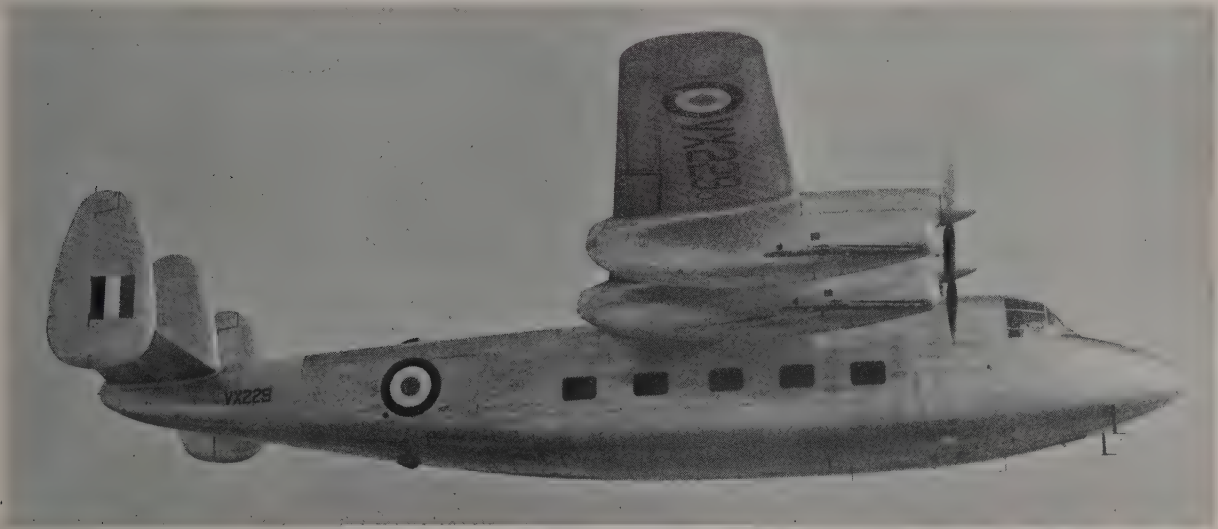
Accommodation.—Flight compartment in nose for crew of two, with separate entry door. Main cabin may be arranged to seat up to 44 passengers in backward-facing seats in high-density version. Standard seating for 36 passengers, with galley, etc. Entire accommodation pressurised. Passenger entry door at rear end of cabin with adjacent door giving access to standard baggage and freight compartment aft. A non-stressed removable bulkhead can be used to permit various combinations of passenger/freight loads, the various bulk-head stations being in the forward part of the cabin. All seats may be removed to convert entire cabin for freight carrying. Seat attachments serve as tie-down points. Passenger and freight loading door sills 3 ft. 6 in. (1.06 m.) from ground.

Dimensions.—
- Span 95 ft. (28.97 m.).
- Length 70 ft. 3 in. (21.42 m.).
- Height over tail 22 ft. 6 in. (6.86 m.).

Weights.—
- Basic operational weight (36-seater) 21,136 lb. (9,587 kg.).
- Max. T.O. and landing weight 34,000 lb. (15,422 kg.).

Performance.—
- Speed at max. weak mixture power (at 32,000 lb. = 14,515 kg. A.U.W.) 231 m.p.h. (372 km.h.) at 13,500 ft. (4,115 m.).
- Rate of climb at 10,000 ft. (3,050 m.) (at 34,000 lb. = 15,422 kg. A.U.W.) 1,125 ft./min. (343 m./min.).
- Time to 10,000 ft. (3,050 m.) 7.7 min.
- Service ceiling 24,500 ft. (7,470 m.).
- Take-off distance to clear 50 ft. (15.25 m.) 576 yds. (430 m.).
- Landing distance from 50 ft. (15.25 m.) 762 yds. (697 m.).

Ranges.—
- With max. payload (10,705 lb. = 4,860 kg.) (at 50% M.E.T.O.) 348 miles (560 km.).
- With full tanks and 6,930 lb. = 3,146 kg. payload (at 50% M.E.T.O.) 1,417 miles (2,280 km.).
- With full tanks and 4,650 lb. (2,111 kg.) payload (at 50% M.E.T.O.) 2,044 miles (3,289 km.).



The Handley Page Marathon T. Mk. II Navigation Trainer (four 340 h.p. D.H. Gipsy Queen engines).

THE HANDLEY PAGE H.P.R.5.

The H.P.R.5 which flew for the first time on March 15, 1955, has been evolved to serve as a flying test-bed for the 850 h.p. Alvis Leonides Major engine. The airframe is that of the Marathon Mk. 2 which was originally powered by two Armstrong Siddeley Mamba turboprop engines.

The H.P.R.5 is fitted with two Leonides Major engines, their installation being similar to that adopted for the H.P.R.3 Herald, previously described.

THE HANDLEY PAGE MARATHON.

The Marathon was designed by Miles Aircraft, Ltd., as a medium range feeder-line aircraft, and production was undertaken by Handley Page (Reading) Ltd. at Woodley. Forty Marathons were built. Of these twelve were completed as Marathon Mk. 1 and 1A civil transports, one Marathon airframe was fitted with two Armstrong Siddeley Mamba turboprop engines for test purposes, to become the solitary Marathon Mk. 2, and the remainder were converted into advanced navigation trainers for the Royal Air Force as the Marathon T. Mk. 11.

The Marathon T. Mk. 11 carries a crew consisting of pilot, signaller, navigator instructor and two student navigators; the last three in aft-facing seats. Instructional equipment includes Rebecca Mk. 4, Gee and radio compass.

A full description and specification of the Marathon has appeared in previous editions of "All the World's Aircraft."

HAWKER

HAWKER AIRCRAFT, LTD.

Registered Office: Canbury Park Road, Kingston-on-Thames, Surrey.

Works and Aerodromes: Canbury Park Road and Richmond Road, Kingston-on-Thames; Dunsfold, Surrey; Langley, Bucks.

Established: 1933.

Chairman: Sir Frank Spencer Spriggs, K.B.E., Hon.F.R.Ae.S.

Directors: Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S.; A. N. Spriggs, O.B.E., M.I.P.E. (Managing Director); J. T. Lidbury, J.P. (General Manager); Sir Sydney Camm, C.B.E., F.R.Ae.S. (Chief Designer); E. H. Jefferson; J. D. Stranks, A.F.R.Ae.S. (Works Director).

Secretary: E. G. Rubython.

HAWKER AIRCRAFT (BLACKPOOL) LTD.

Registered Office: South Shore, Blackpool, Lancs.

Works and Aerodrome: South Shore, Blackpool, Lancs.

Chairman: Sir Frank Spencer Spriggs, K.B.E., Hon. F.R.Ae.S.

Directors: Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S.; A. N. Spriggs, O.B.E., M.I.P.E. (Managing Director); E. H. Jefferson (General Manager); Sir Sydney Camm, C.B.E., F.R.Ae.S. (Chief Designer); J. T. Lidbury, J.P.

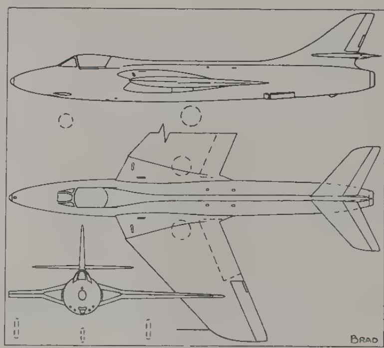
Secretary: A. J. Laurence, A.S.A.A.

Hawker Aircraft, Ltd., was incorporated in 1933 as successor to the H. G. Hawker Engineering Co., Ltd., which was formed in 1920 as the outcome of the voluntary liquidation of the famous Sopwith concern.

The Hawker company produced during the last war a distinguished line of single-seat fighters, of which the Hurricane, the Typhoon, and the Tempest were the best known. From the Tempest was developed the Fury and Sea Fury, both of which have been produced in numbers since the war.

The current types of Hawker aircraft are the Hunter, which is in production for the Royal Air Force and for N.A.T.O., Denmark, Peru and Sweden, and is also built under licence in Holland and Belgium; and the Sea Fury which is still in service in the Royal Navy and the Royal Netherlands Navy, and in non-naval form, with the Royal Iraqi Air Force and the Royal Pakistan Air Force.

The development and production of the Sea Hawk is now the responsibility of Sir W. G. Armstrong Whitworth Aircraft, Ltd., a sister company in the Hawker-Siddeley Group.



The Hawker Hunter.

THE HAWKER HUNTER.

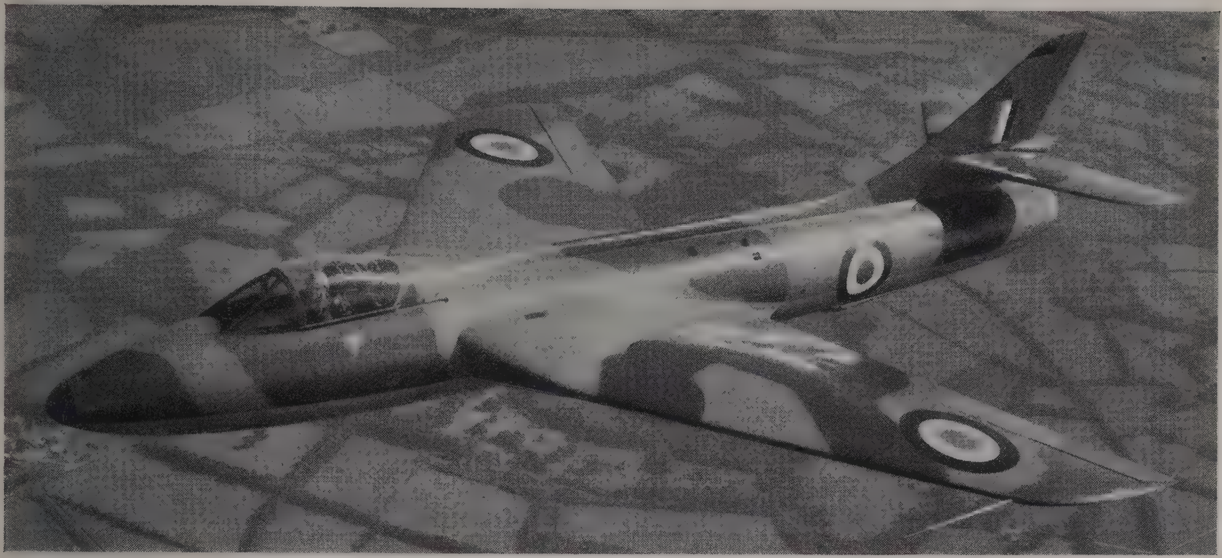
The Hunter is in production for the Royal Air Force, for N.A.T.O. and for the Governments of Denmark, Peru and Sweden.

Under American "off-shore" purchasing arrangements licences for the manufacture of the Hunter have been signed with the Dutch and Belgian Governments. Production in Holland is by Fokker and Aviolanda, and in Belgium by Avions Fairey and SABCA.

Six versions of the Hunter have so far been announced. These are:—

Hunter F. Mk. 1. One Rolls-Royce Avon turbojet engine. Two prototypes were built, the first (WB188) flying for the first time on July 20, 1951, while a


The Hawker Hunter F. Mk. I Fighter (Rolls-Royce Avon turbojet engine).



The Hawker Hunter F. Mk. I Fighter (Rolls-Royce Avon turbojet engine).

second (WB195) made its first flight in May, 1952. The first production F. Mk. 1 flew on November 30, 1952.

Hunter F. Mk. 2. One Armstrong Siddeley Sapphire turbojet engine. Hawker-built prototype (WB202) made its first flight on November 30, 1952. Production aircraft built by Sir W. G. Armstrong Whitworth Aircraft, Ltd.

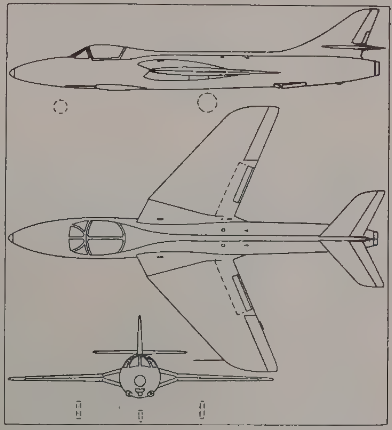
Hunter F. Mk. 3. One Rolls-Royce Avon RA.7 turbojet engine with afterburner. Only one, converted from prototype F. Mk. 1 (WB188). In September, 1953, this aircraft set up World's Speed Records over the 3-kilometre straight course and the 100-kilometre closed-circuit course at 727.6 m.p.h. (1,171 km.h.) and 709 m.p.h. (1,141.4 km.h.) respectively.

Hunter F. Mk. 4. One Rolls-Royce Avon turbojet engine. Mk. 1 with later modifications, including increased internal fuel capacity and provision for underwing stores and drop-tanks.

Hunter F. Mk. 5. One Armstrong Siddeley Sapphire turbojet. Development of Mk. 2 with modifications introduced in Mk. 4. Production by Sir W. G. Armstrong Whitworth Aircraft, Ltd.

Hunter F. Mk. 6. One Rolls-Royce Avon turbojet. Development of the Mk. 4 with more powerful engine.

Hunter F. Mk. 50. Mk. 4 supplied to the Royal Swedish Air Force. Its Swedish designation is J 34.



The Hawker Hunter Two-seater.

All versions of the Hunter are supersonic in shallow dives at height. Armament consists of four 30 mm. Aden cannons installed in a special gun package in the underside of the fuselage nose. This package can be quickly removed for re-arming.

A two-seat side-by-side version of the Hunter has been built. The prototype (XJ615) first flew on July 8, 1955.

No structural details of the Hunter are available for publication.

Dimensions (Mks. 1, 2, 4, 5 and 6).—
Span 33 ft. 8 in. (10.26 m.).
Length 45 ft. 11 in. (13.99 m.).
Height 13 ft. 2 in. (4.26 m.).

Dimensions (Two-seat Hunter).—
Span 33 ft. 8 in. (10.26 m.).
Length 48 ft. 11 in. (14.91 m.).
Height 13 ft. 2 in. (4.26 m.).

THE HAWKER SEA FURY.

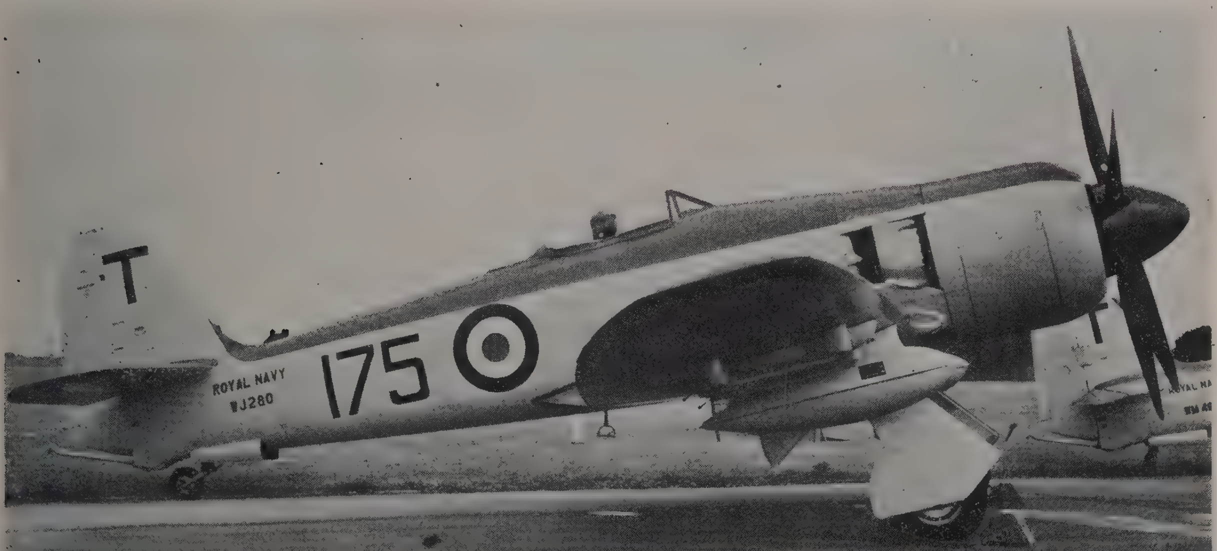
The Sea Fury, which is still in service in the Royal Navy, was the last piston-engined fighter to be built in quantity in the United Kingdom. It has also been built by Fokker for the Royal Netherlands Navy.

In non-naval form, the Fury is in service with the Royal Iraqi Air Force and the Royal Pakistan Air Force.

The following are the principal versions of the Sea Fury :—

Sea Fury F. Mk. 10. First production version. First prototype with Centaurus 15 engine, subsequent aircraft with the Centaurus 18. Fifty built for Royal Navy.

Sea Fury F.B. Mk. 11. 2,470 h.p. Bristol Centaurus 18 engine. Fifty-first production aircraft *et seq.* Similar to F. Mk. 10 but embodying all the small internal modifications introduced progressively in the first 50 airframes.



The Hawker Sea Fury F.B. Mk. II Single-seat Naval Fighter (2,470 h.p. Bristol Centaurus engine). (*J. D. R. Rawlings*).

Supplied to the Royal Navy, Royal Canadian Navy and Royal Australian Navy.

Sea Fury T. Mk. 20. Two-seater trainer version of the Mk. 10. One 20 mm. cannon is deleted from each wing to allow for the installation in the wing of equipment displaced from the fuselage by the second cockpit. Mirror mounted on tripod between cockpit to permit the instructor to use reflector gunsight over head of pupil. This tripod can be quickly removed when the aircraft is not being used for gunnery training. Bombs and rockets or long-range drop tanks can be carried beneath the wings as on the F.B. Mk. 11.

Sea Fury F.B. Mk. 51. Supplied to the Royal Netherlands Navy. Similar to Sea Fury F.B. Mk. 11, but has Dutch language instruments, etc.

A full structural description of the Sea Fury has appeared in previous editions of "All the World's Aircraft."

DIMENSIONS.—
Span 38 ft. 4¾ in. (11.69 m.).
Length 34 ft. 8 in. (10.56 m.).

WEIGHTS AND LOADINGS.—
Weight empty 8,997 lb. (4,090 kg.).
Equipment 1,587 lb. (720 kg.).
Pilot and parachute 200 lb. (91 kg.).
Fuel and oil (normal) 1,566 lb. (710 kg.).
Normal weight loaded 12,350 lb. (5,602 kg.).
Wing loading 44.1 lb./sq. ft. (215 kg./m.^{2}).
Power loading at take-off 5.0 lb./h.p. (2.27 kg. h.p.).

PERFORMANCE (F.B. Mk. 11).—
Max. speed 450 m.p.h. (727 km.h.) at 20,000 ft. (6,100 m.).
Speed at 30,000 ft. (9,150 m.) 415 m.p.h. (670 km.h.).
Initial rate of climb (combat rating) 4,320 ft./min. (1,320 m./min.).
Climb at 20,000 ft. (6,100 m.) 2,850 ft./min. (670 m./min.).
Climb (at combat rating) to 16,000 ft. (4,880 m.) 4.35 minutes.
Climb to 20,000 ft. (6,100 m.) 5.7 minutes.
Climb to 30,000 ft. (9,145 m.) 10.8 minutes.
Radius of action (estimated) at max. economic cruising speed with max. fuel and with 15 minutes combat allowance 720 miles (1,160 km.) at 10,000 ft. (3,050 m.).
Deck take-off run at 12,350 lb. (5,602 kg.) in 31 m.p.h. (50 km.h.) wind 500 ft. (153 m.).
Still air take-off distance 960 ft. (293.m.).

PERFORMANCE (T. Mk. 20).—
Max. speed 370 m.p.h. (597 km.h.) at sea level, 415 m.p.h. (669 km.h.) at 7,500 ft. (2,280 m.) and 445 m.p.h. (717 km.h.) at 20,000 ft. (6,100 m.).
Rate of climb at 5,500 ft. (1,675 m.) 4,300 ft./min. (21.8 m./sec.).
Climb to 5,500 ft. (1,675 m.) in 1.3 min., to 15,000 ft. (4,575 m.) in 4.05 min., to 20,000 ft. (6,150 m.) in 5.65 min.
Max. range 1,630 miles (2,620 km.).
Deck take-off run with drop tanks, in 31 m.p.h. (50 km.h.) wind 600 ft. (183 m.).
Still air take-off distance 1,150 ft. (350 m.).

HAWKER SIDDELEY

HAWKER SIDDELEY GROUP, LTD.

GROUP HEADQUARTERS: 18, ST. JAMES'S SQUARE, LONDON, S.W.1.

Directors: Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S. (Chairman), Sir Frank Spencer Spriggs, K.B.E., Hon. F.R. Ae.S. (Managing Director), H. Burroughes, F.R.Ae.S. (Deputy Managing Director), Sir Roy Dobson, C.B.E., F.R. Ae.S., Sir Arnold Hall, F.R.S., M.A., F.R.Ae.S., H. A. Meredith, O.B.E., H. T. Chapman, C.B.E., M.I.Mech.E., F.R.Ae.S. and J. F. Robertson, C.A.

The Hawker Siddeley Group, which was formed in 1935, is the controlling organisation of Hawker Aircraft, Ltd., Hawker Aircraft (Blackpool), Ltd., Gloster Aircraft Co., Ltd., Sir W. G. Armstrong Co., Ltd., Armstrong Siddeley Motors, Ltd., Brockworth Engineering Co., Ltd., Air Service Training Ltd. and High Duty Alloys, Ltd.; in Canada, A. V. Roe (Canada), Ltd., Avro Aircraft, Ltd., Orenda Engines, Ltd. and Canadian Steel Improvement, Ltd.; and several other subsidiary and associate companies whose work is not directly related to aircraft.

Products of the aircraft and aero-engine manufacturing components of the Group will be found under their individual names in this and the Engine Sections of this book.

HUNTING PERCIVAL

HUNTING PERCIVAL AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: LUTON AIRPORT, LUTON, BEDFORDSHIRE.

Directors: P. Ll. Hunting (Chairman), G. L. Hunting, C. P. M. Hunting, W. A. Summers (Managing), K. D. Morgan (Secretary), R. R. S. Cook, T. Fraser, L. G. Frise, B.Sc., F.R.Ae.S., A.F.I.Ae.S. (Technical), L. C. Hunting and F. W. Buglass, M.I.P.E. (Works).

The Percival Aircraft Company was formed in 1932. It was re-organized as Percival Aircraft Ltd. in 1937, and the works were moved from Gravesend to Luton. A branch office was opened at Toronto, Canada, in 1946. The name was changed to Hunting Percival Aircraft, Ltd. in 1954.

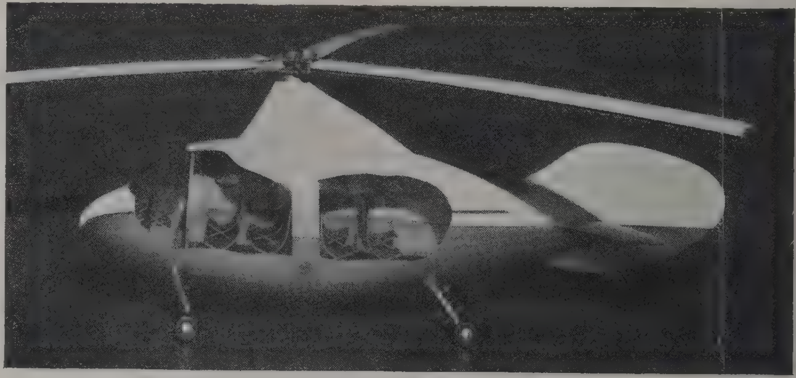
Since the end of the war, the company has produced the Proctor V, a four-seat private, club and charter aircraft, the Prentice basic trainer for the Royal Air Force, and the Prince twin-engined commercial monoplane, including a version specially designed for air survey work.

A new basic trainer, the Provost, has been selected by the Royal Air Force as standard equipment for all R.A.F. Flying Training Schools and is now in service. The Provost has also been ordered by the Southern Rhodesian Air Force, the Eirean Air Corps and the Burma Air Force. A jet version of the Provost, the P.84, is under development.

Developments of the Civil Prince are the Sea Prince, in service with the Royal Navy for communications and crew training, and the Pembroke, which is in service in the Royal Air Force, the Royal Rhodesian Air Force, the Belgian Air Force, the Finnish Air Force and the Swedish Air Force.

Civil Princes are in operation in England, Australia, Thailand, Borneo, Venezuela, Switzerland, South Africa, Brazil, Tanganyika and the U.S.A., and deliveries by air have been made across the Atlantic to North and South America.

The Company is also engaged on the development of helicopters.



A model of the Hunting Percival P.74 Helicopter.

The Hunting Percival P.84 Jet Provost.

THE HUNTING PERCIVAL P.74 HELICOPTER.

The P.74 helicopter is a research aircraft which has been built to obtain information on a new application of tip drive without torque. Two Napier Oryx high-efficiency low-pressure turbo gas-generators supply gas through passages in the rotor blades to jets at the tips. No fuel is burned at the tips in normal flight but after-burning at the tips can be employed to provide extra power for special occasions.

This test helicopter has completed the first series of runs satisfactorily. Design is now proceeding on a production model making use of higher powers now being delivered by the Oryx generators, and this aircraft will have an all-up weight of between 9,000 and 10,000 lb. (4,086-4,540 kg.). It will be a general-purpose type, able to carry a diversity of loads.

THE HUNTING PERCIVAL P.84 JET PROVOST.

The P.84 is a two-seat side-by-side *ab-initio* jet trainer development of the Provost T. Mk. 1, a number of which are being built for the Ministry of Supply. The prototype P.84 flew for the first time on June 26, 1954.

TYPE.—Two-seat Jet Primary and Basic Trainer.

WINGS.—Basically same as for P.56 Provost. Chord 7 ft. 8 in. (2.33 m.) at root, 4 ft. 4 in. (1.31 m.) at tip. Air brakes on wings at rear spar position ahead of flaps. Both air

brakes and flaps are pneumatically-operated. Incidence 2.5° at root. Total flap area 18.22 sq. ft. (1.69 m.²). Total aileron area 24.2 sq. ft. (2.25 m.²). Gross wing area 213.7 sq. ft. (198.5 m.²).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Same as for P.56 Provost.

LANDING GEAR.—Retractable nose-wheel type. Pneumatic retraction. Wheelbase 9 ft. 5.17 in. (3.0 m.). Track 10 ft. 1.4 in. (3.1 m.).

POWER PLANT.—One Armstrong Siddeley Viper ASV.5 axial-flow turbojet engine (1,750 lb. = 790 kg. s.t.) in fuselage aft of cockpit. "Elephant-ear" intakes on each side of forward fuselage and jet exit at rear of fuselage aft of tailplane. Normal internal fuel capacity 171 Imp. gallons (777 litres). Two 50 Imp. gallon (227 litres) wing-tip tanks may be fitted.

ACCOMMODATION.—Enclosed cockpit seating two side-by-side with dual controls in front of leading-edge of wings. Layout of cockpit similar to that of P.56 Provost T. Mk. 1. For armament training two .303 in. machine-guns can be fitted in nose of fuselage, plus two standard reflector sights, one in front of each seat. A variety of underwing stores could be carried such as 6 × 60-lb. (27 kg.) rockets, 8 × 25-lb. (11 kg.) practice bombs or 2 × 250-lb. (113 kg.) general purpose bombs.

DIMENSIONS.—
- Span 35 ft. 5 in. (10.8 m.).
- Length 31 ft. 11 in. (9.7 m.).
- Height 12 ft. 8 in. (3.9 m.).

WEIGHTS.—
- Weight loaded (full internal fuel) 5,950 lb. (2,760 kg.).
- Weight loaded (max. fuel including tip tanks) 6,750 lb. (3,060 kg.).

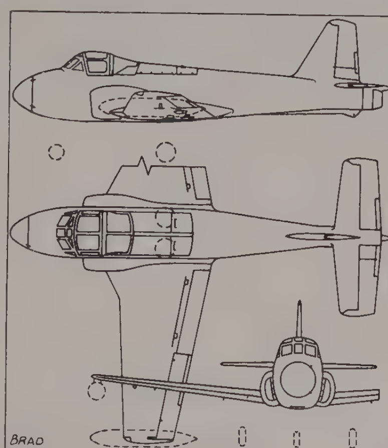
PERFORMANCE (at 5,950 lb. = 2,760 kg. A.U.W.).—
- Max. speed at S/L. 302 m.p.h. (490 km.h.).
- Speed at 10,000 ft. (3,050 m.) 313 m.p.h. (306 km.h.).
- Speed at 20,000 ft. (6,100 m.) 323 m.p.h. (522 km.h.).
- Speed at 30,000 ft. (9,150 m.) 317 m.p.h. (513 km.h.).
- Rate of climb at S/L. 2,520 ft./min, (762 m./min.).
- Climb to 10,000 ft. (3,050 m.) 4.5 min.
- Climb to 20,000 ft. (6,100 m.) 11.9 min.
- Climb to 30,000 ft. (9,150 m.) 24.4 min.
- Ceiling at max. climb power and at rate of climb of 400 ft./min. (120 m./min.) 31,000 ft. (9,450 m.).
- Stalling speed (L/G. and flaps down) 76 m.p.h. (123 km.h.).
- Take-off distance to clear 50 ft. (15.25 m.) 665 yds. (608 m.).
- Landing distance from 50 ft. (15.25 m.) 670 yds. (613 m.).

THE HUNTING PERCIVAL P.56 PROVOST.

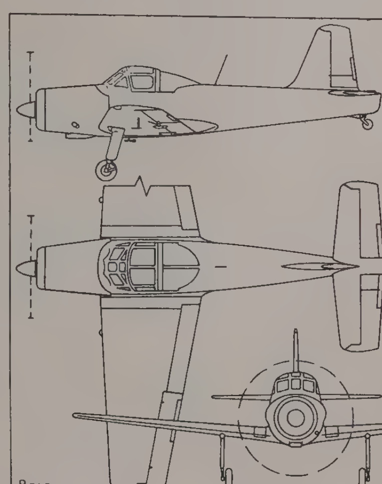
The P.56 trainer was designed to Specification T.16/48 to meet R.A.F. requirements. Three prototypes were built, one fitted with the Armstrong Siddeley Cheetah 18 engine and the other two with the Alvis Leonides engine. The first (Cheetah-engined) prototype flew for the first time on February 23, 1950.

As the result of comprehensive trials the Leonides-engined P.56 was selected as the future R.A.F. basic trainer under the designation Provost T. Mk. 1. This aircraft is now in full production.

The Hunting Percival P.84 Jet Provost (Armstrong Siddeley Viper engine).



The Hunting Percival P.84 Jet Provost.



The Hunting Percival P 56 Provost.

An armed version of the Provost for weapon training (T. Mk. 53) has been supplied to the Air Forces of Rhodesia, Burma, Eire and Iraq. This version can be equipped with the following armament: 2 × .303-in. machine-guns, 1 camera-gun and 2 × 250-lb. bombs, or 8 × 25-lb. bombs, or 8 × 25-lb. bombs and 4 × 60-lb. R.P., or 6 × 60-lb. R.P.

The following description applies specifically to the Provost T. Mk. 1.

TYPE.—Two-seat Basic Trainer.

WINGS.—Cantilever low-wing monoplane. Wing section NACA 23015 (mod.) at root, NACA 4412 (mod.) at tip. Aspect ratio 5.78. Dihedral 6°. Incidence 3°. All-metal stressed skin construction. Metal covered ailerons and trim tabs. Pneumatically-operated slotted flaps. Total flap area 18.94 sq. ft. (1.74 m.²). Gross wing area 214 sq. ft. (20 m.²).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal one-piece tailplane, interchangeable elevators, fin and rudder, the fixed surfaces covered with smooth and movable surfaces with fluted alloy skin. Trim and balance tabs in elevators, combined trim and balance tab in rudder. Span of tailplane 13 ft. 6 in. (4.1 m.). Total horizontal area 48.6 sq. ft. (4.51 m.²). Total vertical area 35.09 sq. ft. (3.26 m.²).

LANDING GEAR.—Fixed tail-wheel type. British Messier oleo-pneumatic shock-absorbers. Differential pneumatic brakes. Dowty liquid-spring tail-wheel strut. Track 11 ft. 1½ in. (3.38 m.).

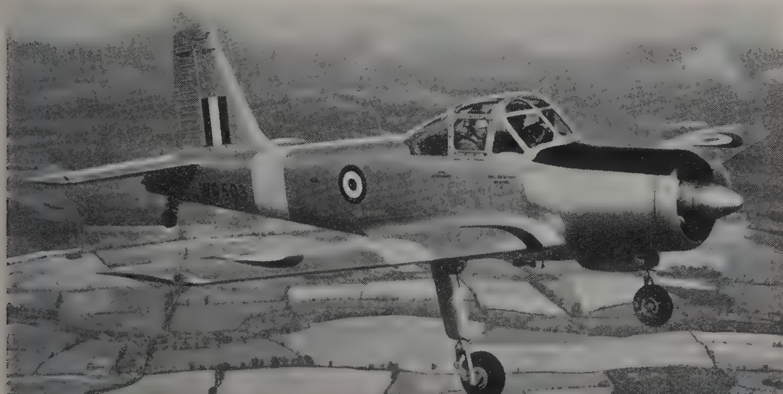
POWER PLANT.—One 550 h.p. Alvis Leonides 25 nine-cylinder air-cooled geared and supercharged radial engine. Three-blade metal constant-speed airscrews, 9 ft. (2.74 m.) diameter. Fuel capacity 66 Imp. gallons (300 litres).

ACCOMMODATION.—Crew of two in enclosed cockpit. Instructor (on starboard) and pupil sit side-by-side, with full dual controls and dual instrument panels. Sliding canopy is mechanically-operated and jettisonable.

DIMENSIONS.—
- Span 35 ft. 2 in. (10.9 m.).
- Length 29 ft. (8.85 m.).
- Overall height (tail up) 12 ft. (3.66 m.).

WEIGHTS AND LOADINGS.—
- Weight empty (equipped) 3,350 lb. (1,521 kg.).
- Crew (2) 400 lb. (182 kg.).
- Fuel and oil 529 lb. (240 kg.).
- Weight loaded 4,400 lb. (2,000 kg.).
- Wing loading 20.6 lb./sq. ft. (100.5 kg./m.²).
- Power loading 8.0 lb./h.p. (3.63 kg./h.p.).

PERFORMANCE.—
- Max. speed 195 m.p.h. (312 km.h.) at sea level and 200 m.p.h. (322 km.h.) at 2,300 ft. (700 m.).
- Max. continuous cruising speed 194 m.p.h. (310 km.h.) at 7,900 ft. (2,410 m.).
- Max. economical cruising speed 177 m.p.h. (283 km.h.) at 11,500 ft. (3,510 m.).
- Stalling speed, flaps down 67 m.p.h. (108 km.h.).
- Initial rate of climb 2,200 ft./min. (11.2 m./sec.).
- Rate of climb at 5,000 ft. (1,525 m.) 1,870 ft./min. (9.5 m./sec.).
- Climb to 5,000 ft. (1,525 m.) 3.3 minutes.
- Climb to 10,000 ft. (3,050 m.) 7.0 minutes.
- Rate of roll (per second) 90 degrees.
- Service ceiling 22,500 ft. (6,860 m.).
- Take-off to 50 ft. (15.2 m.), grass surface 283 yds. (260 m.).
- Landing run 265 yds. (242 m.).
- Duration (at economical weak cruise) 4 hrs.



The Hunting Percival Provost T. Mk. I (550 h.p. Alvis Leonides 25 engine).

The Hunting Percival P.50 Prince III Light Transport (two 550 h.p. Alvis Leonides engines).

THE HUNTING PERCIVAL P.50 PRINCE III.

The Prince, designed mainly for feeder-line and executive travel, first flew at Luton on May 13, 1948. The Prince Series I had an all-up weight of 10,650 lb. (4,835 kg.) and was powered with two 520 h.p. Alvis Leonides 501/4 engines. The Series II and current production Series III have an all-up weight of 11,000 lb. (4,994 kg.).

An improved version of the civil Prince, based on the R.A.F. Pembroke and to be known as the Prince Series V, has been developed. With an all-up weight of 12,500 lb. (5,675 kg.), the new Prince would provide considerably increased payload and range. It would be to the same general configuration as the Pembroke with increased span (64 ft. 6 in.= 19.67 m.) and dual main landing wheels.

The description below refers to the Prince Series III.

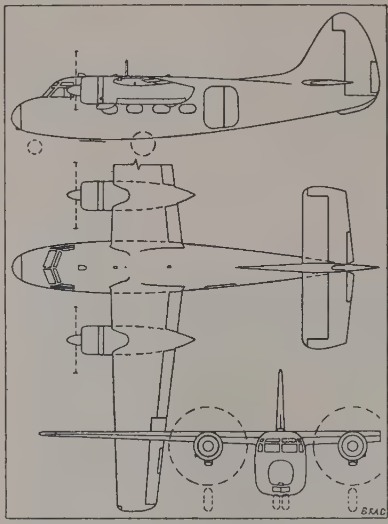
TYPE.—Twin-engined High-wing monoplane for Feeder-line, Charter and Freight-carrying duties.

WINGS.—Cantilever high-wing monoplane. Aspect ratio 8.6. All-metal two-spar stressed-skin structure. Detachable tips. All-metal ailerons. Trim-tab in port aileron and geared tab in starboard. NACA slotted flaps. Leading-edges of wings may be fitted with Goodrich pulsating de-icer boots. Gross wing area 365 sq. ft. (33.9 m.^{2}).

FUSELAGE.—All-metal monocoque structure in two main sections. Nose detachable for access to controls, instruments and electrical gear.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with fixed surfaces covered with smooth and movable surfaces with fluted light alloy skin. Tailplane and fin may be fitted with Goodrich de-icer boots. Span of tail 18 ft. 9 in. (5.71 m.). Trim and geared tabs in elevators and rudder.

LANDING GEAR.—Retractable tricycle type. Oleo-pneumatic shock-absorbers. Non-steerable self-centering nose-wheel. Pneumatic retraction, with emergency gear. Pneumatic brakes on main wheels. Track 16 ft. 6 in. (5.0 m.).



The Hunting Percival P.50 Prince III.

POWER PLANT—Two 550 h.p. Alvis Leonides 24 (502/4) nine-cylinder radial air-cooled engines. De Havilland three-blade constant-speed feathering and braking airscrews 9 ft. (2.74 m.) diameter. Normal fuel in four interconnected crashproof tanks in wings, inner tanks having 53 Imp. gals. (242 litres) capacity each and outer tanks 33.5 Imp. gals. (152 litres) each. Total standard fuel capacity 173 Imp. gals. (786 litres). Provision for fitting 60 Imp. gals. (274 litres) outer wing tanks in lieu of standard 33.5 gal. tanks. 100 Imp. gals. (455 litres) long-range ferrying tank may be installed in fuselage. 7.3 Imp. gal. (33 litre) oil tank in each engine nacelle.

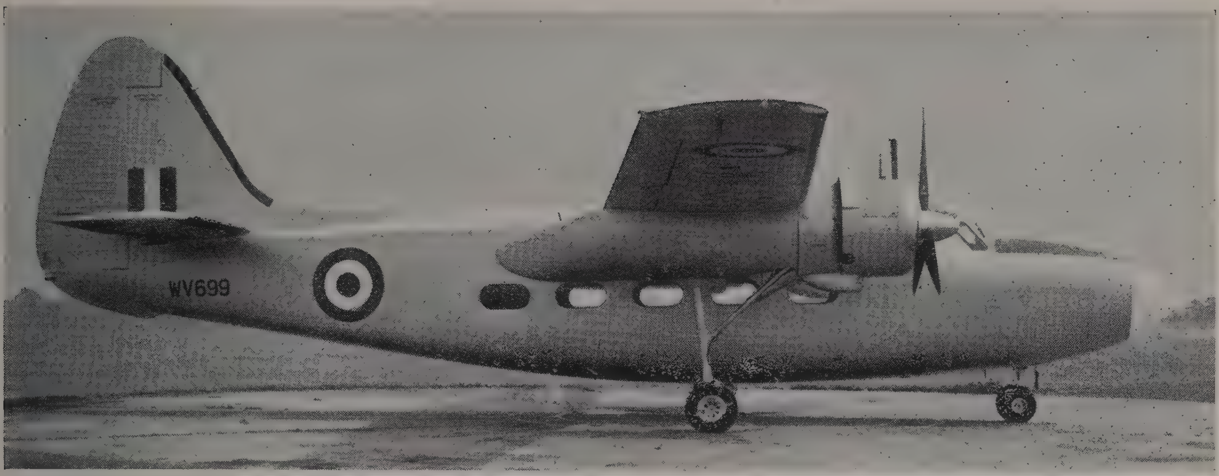
ACCOMMODATION.—Crew of two side-by-side with provision for dual controls. Entry door in bulkhead aft of cockpit. Main passenger cabin 15 ft. 0 in. long × 5 ft. 6 in. wide × 6 ft. 0 in. high (4.57 × 1.68 × 1.8 m.) with entry door 5 ft. 0 in. × 2 ft. 3 in. (1.68 × 6.8 m.) at rear on port side. Standard cabin interior arrangement has seats for eight passengers with central gangway 14½ in. (37 cm.) wide. Overhead racks for personal luggage. Toilet compartment at rear on starboard side opposite main entry door. Aft of toilet is baggage compartment with floor area of 12.7 sq. ft. (1.18 m.^{2}) and capacity of 72 cub. ft. (2.04 m.^{3}). Access by door immediately adjacent to passenger door. With toilet bulkhead and fittings removed two or four additional passenger seats can be installed or alternatively all interior equipment can be removed and entire cabin space used for freight-carrying. Built-in tie-down fittings, which do not project into passenger accommodation.

DIMENSIONS.—
- Span 56 ft. (17.3 m.).
- Length 42 ft. 10 in. (13 m.).
- Height over rudder 16 ft. 1 in. (4.9 m.).

WEIGHTS AND LOADINGS (Standard 8-passenger version).—
- Weight empty (equipped) 8,038 lb. (3,649 kg.).
- Crew (2) 340 lb. (154 kg.).
- Fuel and oil 853 lb. (387 kg.).
- Passengers (8) 1,360 lb. (617 kg.).
- Luggage and freight 409 lb. (185 kg.).
- Weight loaded 11,000 lb. (4,989 kg.).
- Wing loading 30.1 lb./sq. ft. (147 kg./m.^{2}).
- Power loading 10 lb./h.p. (4.47 kg./h.p.).

PERFORMANCE (at 11,000 lb.=4,989 kg.).—
- Max. speed 223 m.p.h. (359 km.h.) at sea level and 229 m.p.h. (368 km.h.) at 5,000 ft. (1,050 m.).
- Max. rich mixture cruising speed 197 m.p.h. (315 km.h.) at sea level 212 m.p.h. (341 km.h.) at 5,000 ft. (1,525 m.).
- Max. weak mixture cruising speed 166 m.p.h. (267 km.h.) at sea level, 178 m.p.h. (286 km.h.) at 5,000 ft. (1,525 m.).
- Stalling speed, power off, flaps down 75 m.p.h. (121 km.h.).

The Hunting Percival P.54 Prince IIIA Air Survey Monoplane (two 550 h.p. Alvis Leonides engines).



The Hunting Percival Pembroke C. Mk. I Military Communications monoplane (two Alvis Leonides engines).

Initial climb 1,650 ft./min. (8.25 m./sec.).
Service ceiling 23,400 ft. (7,140 m.).
Service ceiling (one engine) 10,000 ft. (3,050 m.).
Take-off run (sea level I.C.A.N. conditions) 466 yds. (373 m.).
Take-off to 50 ft. (15.2 m.) 800 yds. (695 m.).
Take-off to 50 ft. (15.2 m.) (one engine) 1,140 yds. (1,005 m.).
Landing run (sea level I.C.A.N. conditions) 440 yds. (329 m.).
Still air range at weak mixture cruising at 5,000 ft. (1,525 m.) with 173 Imp. gallons (785 litres) fuel 894 miles (1,440 km.) at 151 m.p.h. (243 km.h.) 818 miles (1,315 km.) at 165 m.p.h. (266 km.h.) and 740 miles (1,190 km.) at 178 m.p.h. (286 km.h.).
Still air range at weak mixture cruising at 5,000 ft. (1,525 m.) with 106 Imp. gallons (482 litres) fuel 550 miles (885 km.) at 151 m.p.h. (243 km.h.), 501 miles (806 km.) at 165 m.p.h. (266 km.h.) and 453 miles (729 km.) at 178 m.p.h. (286 km.h.).
Still air range at weak mixture cruising at 10,000 ft. (3,050 m.) with 173 Imp. gallons (785 litres) fuel 902 miles (1,450 km.) at 159 m.p.h. (256 km.h.) 853 miles (1,370 km.) at 178 m.p.h. (286 km.h.) and 752 miles (1,210 km.) at 190 m.p.h. (306 km.h.).
Still air range at weak mixture cruising at 10,000 ft. (3,050 m.) with 106 Imp. gallons (482 litres) fuel 552 miles (888 km.) at 159 m.p.h. (256 km.h.), 520 miles (837 km.) at 178 m.p.h. (286 km.h.) and 461 miles (742 km.) at 190 m.p.h. (306 km.h.).

THE HUNTING PERCIVAL P.54 SURVEY PRINCE III A.

This version of the Prince has been developed for aerial survey work. In general it is similar to the standard Prince III, the major alteration being the extended nose containing an observer photographer's position, which gives a wide unobstructed view ahead from well above the horizon to a point 10 degrees aft of the vertical below the aircraft.

The floor of the main cabin has been modified to incorporate two camera hatches, each 23 in. × 21 in. (58.5 cm. × 53.4 cm.). There are also two circular ports in place of the fourth cabin side windows, through which cameras can be used in conjunction with the aft vertical camera for horizon-to-horizon tri-metrogon photography. Design of the camera positions is such as to allow for the use of most current air survey cameras.

The Survey Prince is equipped with Smith's S.E.P.1 electronic auto pilot and oxygen and heating for all crew members.

The tank capacity is 226 Imp. gal. (1,027 litres), giving an endurance of 6 hours and a still air range (with no allowances) of 1,000 miles (1,600 km.) when cruising at a true speed of 172 m.p.h. (275 km.h.) at 10,000 ft. (3,050 m.).

The Survey Prince is also readily convertible for the carriage of 8 to 10 passengers or freight. Fixed fittings may be supplied to enable the aircraft to be used as an ambulance to carry six stretcher cases plus attendants.

Weights.—
Bare weight 7,436 lb. (3,373 kg.).
Fixed equipment 509 lb. (230 kg.).
Removable equipment 455 lb. (207 kg.).
Tare weight 8,400 lb. (3.810 kg.).
Disposable load 2,600 lb. (1,179 kg.).
All-up weight 11,000 lb. (4,989 kg.).

Performance.—
Same as for Prince III.

THE HUNTING PERCIVAL P.57 SEA PRINCE.

Developed from the earlier Prince III, the following versions of the Sea Prince are in service in the Royal Navy.

Sea Prince C. Mk. 1. Communications aircraft similar to the civil Prince Series II but carrying extra equipment. One used by Flag Officer (Air) Home and another by the naval staff with the British Joint Services Mission in Washington, D.C., U.S.A.

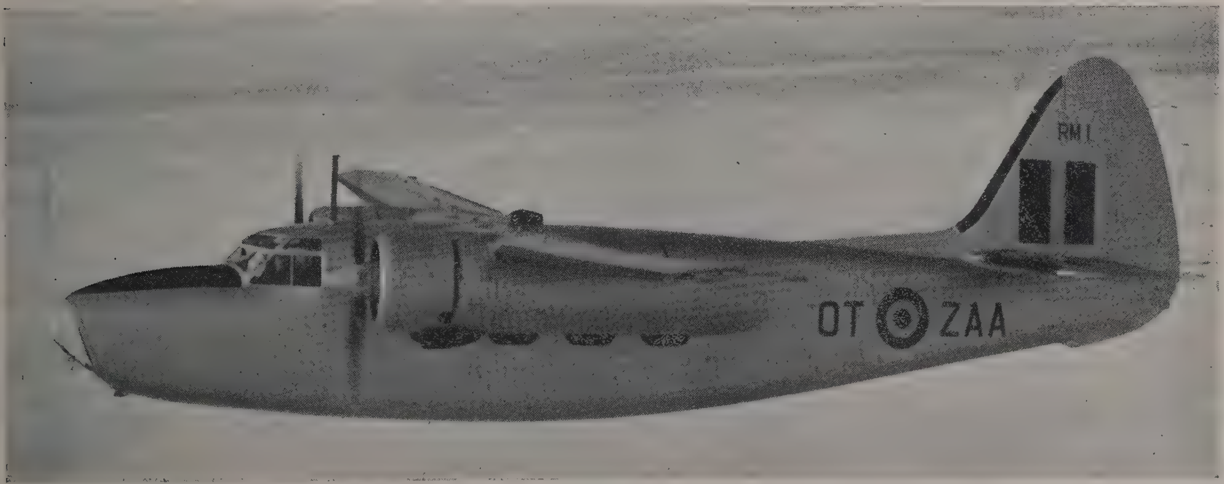
Sea Prince C. Mk. 2. Improved version with increased disposable load. Accommodates crew of two and eight passengers in rearward-facing seats. Strengthened landing-gear with dual main wheels. Length: 46 ft. (14.0 m.). All-up weight 11,850 lb. (5,380 kg.).

Sea Prince T. Mk. 1. Training aircraft for instruction in navigation and anti-submarine warfare. Carries extensive radio and radar equipment. Landing-gear modified and fitted with dual main wheels. Lengthened nose. All-up weight 11,850 lb. (5,380 kg.).

THE HUNTING PERCIVAL P.66 PEMBROKE.

The Pembroke C. Mk. 1 is an eight-seat communications version of the Prince with increased disposable load and all-up weight which is in production for the Royal Air Force. It is also adaptable for freighting, long-range ferrying and casualty evacuation.

Fixed fittings in the cabin are provided for eight 15G rearward-facing seats, for stretchers or for lashing down cargo. The main cabin door is removable for parachuting freight and equipment.



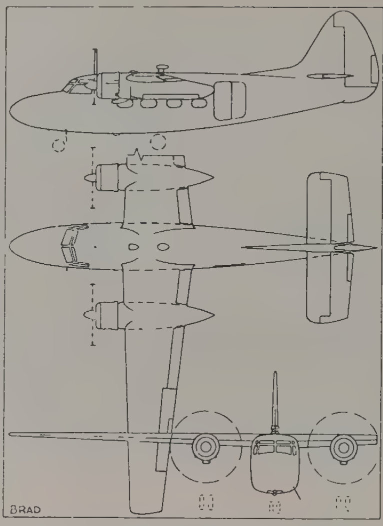
The Hunting Percival Pembroke (two Alvis Leonides engines) as supplied to the Belgian Air Force.

De-icing equipment, reversible-pitch airscrews and dual-wheel main landing-gear units are fitted. A fixed supply of oxygen is provided for the crew, with portable oxygen equipment for the passengers.

The Pembroke in service with the Royal Rhodesian Air Force is identical to the R.A.F. Pembroke except that de-icing equipment is not fitted.

The Pembroke in service with the Belgian Air Force incorporates a number of modifications as compared with the R.A.F. Pembroke C. Mk. 1. The principal modification consists of fitting a clear-view photographic sighting nose, together with an optically flat window in the nose compartment and vertical and oblique camera apertures in the main cabin, for air survey and photography.

There is a separate crew compartment in the passenger-carrying version with accommodation for pilot, co-pilot, radio operator and navigator. Removable dual controls are fitted so that the aircraft may also be used for twin-engine pilot training, with two-stage amber screening for cloud or night flying training.



The Hunting Percival Pembroke C. Mk. I.

The Pembroke for the Swedish Air Force is provided with seats for ten passengers but is otherwise similar to the R.A.F. Pembroke C. Mk. 1.

DIMENSIONS.—
- Span 64 ft. 6 in. (19.6 m.).
- Length 46 ft. 0 in. (14.0 m.).
- Height 16 ft. 1 in. (4.9 m.).

WEIGHTS (Communications version).—
- Weight empty (equipped) 8,969 lb. (4,068 kg.).
- Fuel, oil and crew 2,299 lb. (1,044 kg.).
- Eight passengers and baggage 1,732 lb. (786 kg.).
- Weight loaded 13,000 lb. (5,903 kg.).

PERFORMANCE.—
- Max. speed at 2,000 ft. (610 m.) 220 m.p.h. (354 km.h.).
- Max. rich mixture cruising speed 209 m.p.h. (337 km.h.) at 5,000 ft. (1,525 m.).
- Max. weak mixture cruising speed 185 m.p.h. (302 km.h.) at 10,000 ft. (3,050 m.).
- Most economic cruising speed 150 m.p.h. (241 km.h.) at 8,000 ft. (2,440 m.).
- Initial rate of climb 1,500 ft./min. (7.62 m./sec.).
- Climb to 6,000 ft. (1,830 m.) 5.6 min.
- Climb to 10,000 ft. (3,050 m.) 10.5 min.
- Climb to 20,000 ft. (6,100 m.) 34.4 min.
- Service ceiling 22,000 ft. (6,070 m.).
- Range (still air) 1,030 miles (1,657 km.) at 150 m.p.h. (251 km.h.). at 8,000 ft. (2,440 m.).

M.L.

M.L. AVIATION COMPANY, LTD.

HEAD OFFICE: UNITED BUILDING, TRADING ESTATE, SLOUGH, BUCKINGHAMSHIRE.

WORKS AND AERODROME: WHITE WALTHAM, MAIDENHEAD, BERKSHIRE.

Directors: Sir Noel Mobbs, K.C.V.O., O.B.E. (Chairman); E. N. Mobbs (Managing Director); M. J. O. Lobelle, M.I. Mech.E., F.R.Ae.S. (Chief Designer); R. O. Mobbs, J.P. and A. J. Wilson.

M.L. Aviation Co., Ltd., formerly R. Malcolm, Ltd., are designers and manufacturers of radio-controlled pilotless targets, high-speed target-towing apparatus, as well as various other kinds of aircraft equipment.

The company has produced the M.L. Utility inflatable-wing monoplane for which the Ministry of Supply has placed a contract for a number of developed prototypes.

THE M.L. UTILITY.

The M.L. Utility, which was designed by Mr. M. J. Lobelle, who was formerly chief designer of the Fairey Aviation Co., Ltd., comprises a large delta-shaped wing of rubberised fabric and a pendant nacelle of simple form, at the rear end of which is mounted a 60 h.p. McCulloch flat-four two-stroke engine which drives a pusher propeller.

The wing envelope is provided with span-wise diaphragms which maintain its aerofoil shape when inflated. Air-filled "elevons" are mounted at the outer extremities of the wing, while a vertical stabilising surface is located on the centre-line aft. A wind-driven pump and a safety-valve are provided to assist in maintaining constant pressure. The wing may be deflated for stowage and transport purposes.

The nacelle on the first experimental prototype, which is illustrated herewith, accommodates two in tandem. It is attached to the underside of the wing by four struts and wire bracing, and carries the simple tricycle landing-gear.

The M.L. Utility in its present form has an empty weight of 500 lb. (227 kg.) and can carry a useful load of 400 lb. (182 kg.). It has a speed of about 45 m.p.h. (72 km.h.) and a range of 100 miles (160 km.).

The M.L. Utility Monoplane which has an inflatable delta wing with a span of 40 ft. (12.2 m.).

MILES

F. G. MILES, LIMITED.

HEAD OFFICE AND WORKS: SHOREHAM AIRPORT, SUSSEX.

Directors: F. G. Miles, F.R.Ae.S. (Chairman and Managing Director), Mrs. M.F. M. Miles, Dennis Daybell, G. H. Miles, M.S.A.E. (Chief Designer), J. W. P. Angell and Mrs. O. M. Wadlow (Secretary).

F. G. Miles, Ltd. was formed in 1951 to design and build aircraft, to undertake aerodynamic and flight research and to conduct experimental work in structural plastics.

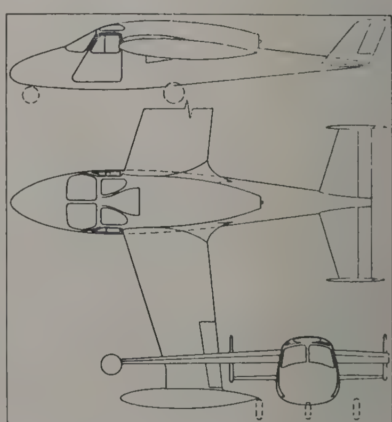
Mr. F. G. Miles has been associated with the aircraft industry since 1933 when Phillips & Powis Aircraft (Reading) Ltd. introduced the original Miles Hawk. Phillips & Powis Aircraft, Ltd. was formed as a public company in 1935 to take over the aircraft manufacturing business of Phillips & Powis Aircraft (Reading) Ltd. and in 1943 the company's name was changed to Miles Aircraft, Ltd.

Between 1933 and 1948, when Miles Aircraft Ltd. ceased to exist as an aircraft manufacturing company, a great variety of both civil and military aircraft types bearing the Miles name emanated from the Reading factory, the best-known being the Hawk Series, Falcon, Magister, Master, Martinet, Messenger, Gemini, Aerovan and Marathon, the last-mentioned being subsequently produced by Handley Page (Reading), Ltd.

The first products of F. G. Miles, Ltd. are conversions of earlier Miles designs and are described hereafter.

The company has begun the construction, as a private venture, of the M.100 Student, a basic training or communications monoplane which will be powered by either one Turbomeca Marboré II or two Palas turbojet engines.

In conjunction with the French Société des Avions Hurel-Dubois, Miles is building a development of the M.57 Aerovan,



The Miles M.100 Student.

which will be fitted with a Hurel high aspect ratio strutted wing. This aircraft, which will be known as the M.105, is being built with a view to making a complete evaluation of the Hurel wing formula by comparing its performance with that of a standard M.57 Aerovan, using the same power-units. Some details of the M.105 appear hereafter.

The company's Plastics Division has expanded considerably in the past year or so and phenolic-asbestos components are being produced in quantity for installation in some of the latest high-speed aircraft.

A considerable development programme is also in hand in connection with guided missiles.

THE MILES M.105.

The M.105 is an experimental version of the M.65 Aerovan which has been fitted with a Hurel strutted wing of similar area to that of the standard Aerovan but which has an aspect ratio of 20.4 instead of 5.6.

TYPE.—Twin-engined experimental monoplane.

WINGS.—High-wing strut-braced monoplane. NACA 63 Series wing section. Aspect ratio 20.4. Chord 4 ft. 7 in. (1.39 m.) at tip, 2 ft. 3½ in. (0.68 m.) at tip. Dihedral 3°. Incidence 2°. Aluminium-alloy single-spar structure. Slotted flaps. Frise type ailerons. Total area of flaps 45 sq. ft. (4.18 m.²). Area of ailerons 12 sq. ft. (1.11 m.²). Gross wing and lifting strut area 388 sq. ft. (36.0 m.²).

FUSELAGE.—All-wood plywood-covered structure. All-metal tail-boom springing from top of rear fuselage carries tail-unit.

TAIL UNIT.—Cantilever monoplane type with three fins and rudders. All-wood plywood-covered structure. Areas: fins 22 sq. ft. (2.04 m.²), rudders 18 sq. ft. (1.67 m.²), tailplane 50 sq. ft. (4.64 m.²), elevators 25 sq. ft. (2.32 m.²). Span of tailplane 16 ft. 6 in. (5.0 m.).

LANDING GEAR. Fixed nose-wheel type. Main wheels have articulated suspension units mounted directly to fuselage sides. Steerable nose-wheel. Goodyear wheels and disc-type brakes. Wheelbase 9 ft. 6 in. (2.89 m.). Track 16 ft. 9 in. (5.10 m.).

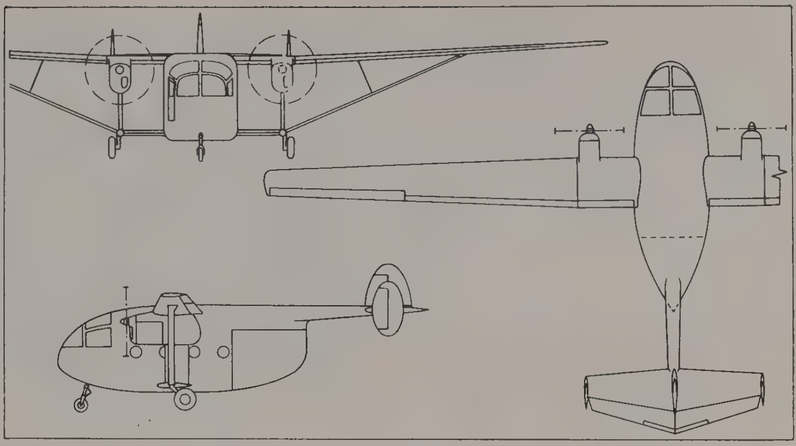
POWER PLANT.—Two 155 h.p. Blackburn Cirrus Major III four-cylinder in-line inverted air-cooled engines. Fixed-pitch wood airscrews.

ACCOMMODATION.—Standard Aerovan accommodation provides for crew of two in flight compartment and an unobstructed freight cabin with rear loading doors beneath tail-boom. Can also be arranged to seat six passengers.

DIMENSIONS.—
Span 75 ft. 4 in. (22.97 m.).
Length 34 ft. 4 in. (10.40 m.).
Height 13 ft. 11 in. (4.25 m.).

WEIGHTS.—
Weight empty 3,219 lb. (1,461 kg.).
Max. loaded weight 6,170 lb. (2,801 kg.).

PERFORMANCE (Estimated).—
Max. speed at S/L. 133 m.p.h. (212 km.h.).
Max. speed at 5,000 ft. (1,525 m.) 130 m.p.h. (208 km.h.).
Cruising speed at S/L. 119 m.p.h. (190 km.h.).
Cruising speed at 5,000 ft. (1,525 m.) 121 m.p.h. (194 km.h.).
Initial rate of climb 650 ft./min. (198 m./min.).
Rate of climb at 5,000 ft. (1,525 m.) 500 ft./min. (152.5 m./min.).
Rate of climb at 5,000 ft. (1,525 m.) on one engine 65 ft./min. (20 m./min.).
Service ceiling 18,350 ft. (5,600 m.).
Service ceiling on one engine 2,625 ft. (700 m.).
Min. T.O. run 175 yds. (160 m.).
Take-off distance to clear 50 ft. (15.25 m.) 417 yds. (381 m.).



The Miles M.105 with the Hurel high aspect ratio wing.

THE MILES M.75 ARIES.

The Aries four-seat cabin monoplane was developed from the M.65 Gemini design. The fuselage and wings are similar but are strengthened for increased all-up weight and performance. Either two 155 h.p. Blackburn Cirrus Major III or 145 h.p. D.H. Gipsy Major 10 engines are carried in welded steel engine mountings designed to improve accessibility for maintenance. The tail-unit is re-designed to provide the improved control and stability characteristics which are required owing to a power increase of over 50 per cent. The prototype first flew on March 21, 1951.

Standard M.65A Gemini may now be converted to M.75 Aries to order.

TYPE.—Twin-engined Four-seat Cabin monoplane.

WINGS.—Wooden cantilever low-wing monoplane. Aspect ratio 6.86. Two-spar structure built in one piece, spars passing through the fuselage. Wooden box spars, spruce girder ribs and plywood covering. Metal strip trailing-edge. All-wood plywood-covered slotted ailerons and Miles non-retractable auxiliary aerofoil flaps hinged to trailing-edge. Gross wing area 191 sq. ft. (17.7 m.²).

FUSELAGE.—All-wood structure built in two sections joined at the rear spar. Each section has four spruce longerons and U-frames each composed of outer and inner laminated spruce members interspaced by blocks and reinforced where necessary. Light alloy tail fairing. Maximum width 4 ft. 0 in. (1.22 m.).

TAIL UNIT.—Wooden structure with plywood skin. Cantilever tailplane with twin end-plate fins and rudders. Light alloy combined servo-and-trim tabs on elevators. Tailplane span 12 ft. 9 in. (3.88 m.).

LANDING GEAR.—Each main unit consists of a Miles oleo-pneumatic articulated-suspension shock-absorber hinged to the nacelle structure and retracted by an electric actuator. Wheels attached to stub axles. Hydraulic disc brakes on main wheels. Non-retractable tailwheel carried in fork on shock-absorber strut. Track 10 ft. 11 in. (3.32 m.).

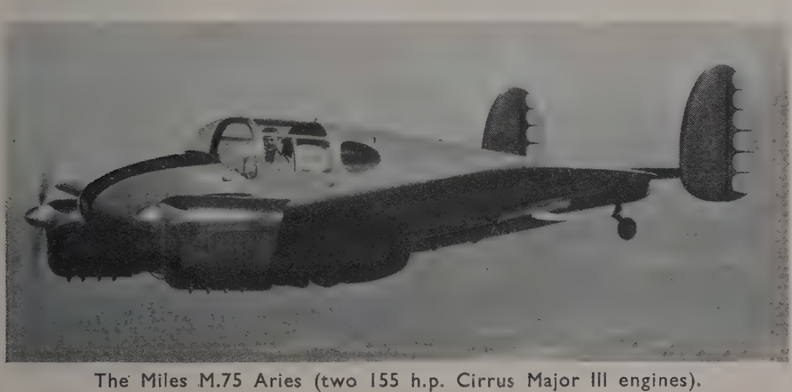
POWER PLANT.—Two 155 h.p. Blackburn Cirrus Major III or 145 h.p. D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engines in semi-cantilever mountings. Fairey-Reed two-bladed fixed-pitch metal airscrews. Two 18 gallon (82 litre) and two 12 gallon (54.5 litre) crashproof tanks in the wing. Two 2½ gallon (11.4 litre) oil tanks in wing leading-edge.

ACCOMMODATION.—Enclosed sound-proofed cabin seating four; two separate front seats hinging forward for access to rear bench-type seat. Rudder pedals adjustable. Dual control optional. Maximum interior width 3 ft. 9 in. (1.14 m.). Spring-loaded access doors on each side hinged on top centre-line of fuselage. Large luggage compartments in nose and rear fuselage accessible from outside.

DIMENSIONS.—
Span 36 ft. 2 in. (11.0 m.).
Length 22 ft. 5 in. (6.83 m.).
Height (tail down) 7 ft. 6 in. (2.28 m.).

WEIGHTS AND LOADINGS (Cirrus Major III engines).—
Weight empty (with full equipment including radio) 2,462 lb. (1,118 kg.).
Disposable load 1,013 lb. (460 kg.).
Max. loaded weight 3,475 lb. (1,578 kg.).
Wing loading 18.1 lb./sq. ft. (88.32 kg./m.²).
Power loading 11.2 lb./h.p. (5.08 kg./h.p.).

PERFORMANCE (Cirrus Major III engines).—
Max. speed 172 m.p.h. (275 km.h.) at 1,000 ft. (305 m.).
Cruising speed 150 m.p.h. (240 km.h.) at 1,000 ft. (305 m.).
Initial rate of climb 1,300 ft./min. (396.5 m./min.).
Rate of climb on one engine 180 ft./min. (55 m./min.).
Max. still air range 675 miles (1,080 km.).
Take-off distance to clear 50 ft. (15.25 m.) 425 yds. (390 m.).
Landing run 180 yds. (165 m.).



The Miles M.75 Aries (two 155 h.p. Cirrus Major III engines).

THE MILES M.77 SPARROWJET.

The Sparrowjet is the first light jet-powered racing aircraft to be built in England. Based on the airframe of the prototype Sparrowhawk, G-ADNL, in which Mr. F. G. Miles won the speed prize in the 1935 King's Cup Air Race, it has been extensively rebuilt to be powered by two Turbomeca Palas turbojet engines.

The engines are installed in the wing roots, the original Gipsy Major engine in the nose having been replaced by a new cockpit with a moulded Perspex canopy.

In its re-designed form the aircraft first flew on December 14, 1953.

TYPE.—Single-seat twin-turbojet racing and research aircraft.

WINGS.—Cantilever low-wing monoplane. Two-spar wooden structure built in two sections and attached to metal spars extending across the engine bays. Spruce and ply-wood box spars, spruce girder ribs and plywood covering. Wooden split flaps and plain mass-balanced ailerons

hinged to auxiliary spar. Gross wing area 156 sq. ft. (14.39 m.²).

FUSELAGE.—Spruce framework with plywood-covering.

TAIL UNIT.—Cantilever monoplane tailplane mounted at the base of the fin. Plain control surfaces mass balanced. Wooden framework with plywood skin. Small light-alloy tip fins.

LANDING GEAR.—Fixed tail-wheel type. Cantilever oleo legs attached to the front spar. Wheels attached to stub axles outboard of the struts and enclosed in light alloy fairings. Goodyear disc brakes. Spring tail-skid with small castoring wheel.

POWER PLANT.—Two Turbomeca Palas turbojet engines (330 lb. = 150 kg. s.t. each) in the wing roots are attached to the metal wing spars in the engine bays and enclosed in light alloy cowlings. Two fuel tanks (40 Imp. gallons = 182 litres each) in the wings supply either engine. Two ½ gallon (2.2 litre) oil tanks in the engine bays.

ACCOMMODATION.—Single seat cockpit in the nose enclosed by a frameless canopy which is hinged to open aft and is jettisonable.

DIMENSIONS.—
Span 28 ft. 8 in. (8.74 m.).
Length 27 ft. 7 in. (8.42 m.).
Height (tail down) 5 ft. 6 in. (1.67 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,450 lb. (658 kg.).
Disposable load 950 lb. (432 kg.).
Weight loaded 2,400 lb. (1,090 kg.).
Wing loading 15.4 lb./sq. ft. (75.15 kg./m.²).

PERFORMANCE.—
Not available.

The Miles M.77 Sparrowjet (two Turbomeca Palas turbojet engines).

SAUNDERS-ROE

SAUNDERS-ROE, LTD.

HEAD OFFICE: OSBORNE, EAST COWES, ISLE OF WIGHT.

WORKS: EAST COWES, ISLE OF WIGHT, AND AT SOUTHAMPTON AIRPORT, EASTLEIGH, HANTS.

HELICOPTER DIVISION: SOUTHAMPTON AIRPORT, EASTLEIGH, HANTS.

President: Sir Alliott Verdon-Roe, O.B.E., Hon. F.R.Ae.S., M.I.Ae.E.

Directors: The Hon. H. N. Morgan-Grenville, O.B.E. (Chairman), Sir Arthur Gouge, B.S., F.R.Ae.S., M.I.Mech.E. (Vice-Chairman), Captain E. D. Clarke, M.C. (Managing Director), W. Browning, F.R.Ae.S., A.M.I.Mech.E., M.I.P.E. (General Manager), H. Knowler, A.M.I.C.E., F.R.Ae.S. (Technical), R. V. Perfect (Sale and Publicity), The Hon. M. F. P. Lubbock, M. D. N. Wyatt and P. D. Irons, B.Com., A.C.A., F.C.W.A. (Secretary).

Saunders-Roe are specialists in the design and construction of flying-boats over many years. Present research programmes include the development of flying-boat hulls for operation in open ocean conditions, and applications of hydro-skis to aircraft.

The Saunders-Roe Helicopter Division was formed on January 22, 1951, when the company took over the premises, current design commitments and technical staff of the Cierva Autogiro Co., Ltd.

THE SAUNDERS-ROE SR/45 PRINCESS.

Design of the Princess began originally in 1943, as an extension of the company's ideas for a large long-range commercial flying-boat.

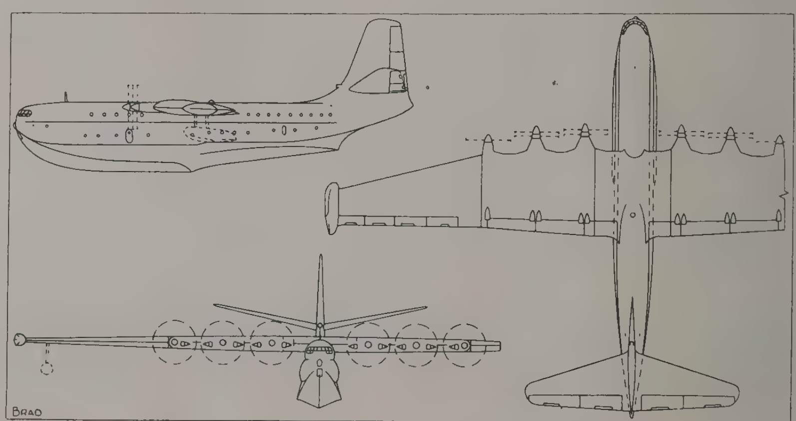
In July, 1945, the company was invited by the Ministry of Supply to tender for the construction of an aircraft of this type, and in May, 1946, the building of three flying-boats was authorised. At that time B.O.A.C. had signified their interest in the project, envisaging its use on the direct London-New York route.

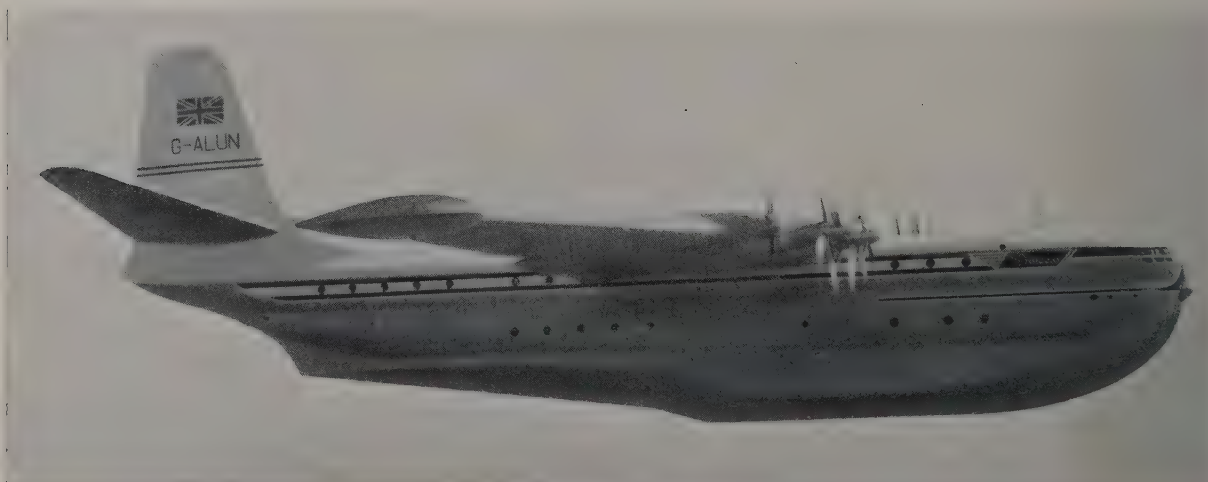
Early in 1951, B.O.A.C., by then fully committed to landplane operations, decided not to operate the Princess. Thereupon it was officially announced that the three Princesses being built would be completed for the R.A.F. as long-range military transports.

In March, 1952, a further official pronouncement declared that the first Princess, powered by ten Proteus 600 Series engines, would be completed, but that work on the second and third boats would be temporarily stopped to await production of the more powerful Proteus 700 Series engines for which the Princess was designed, and to release capacity for more urgently-needed construction.

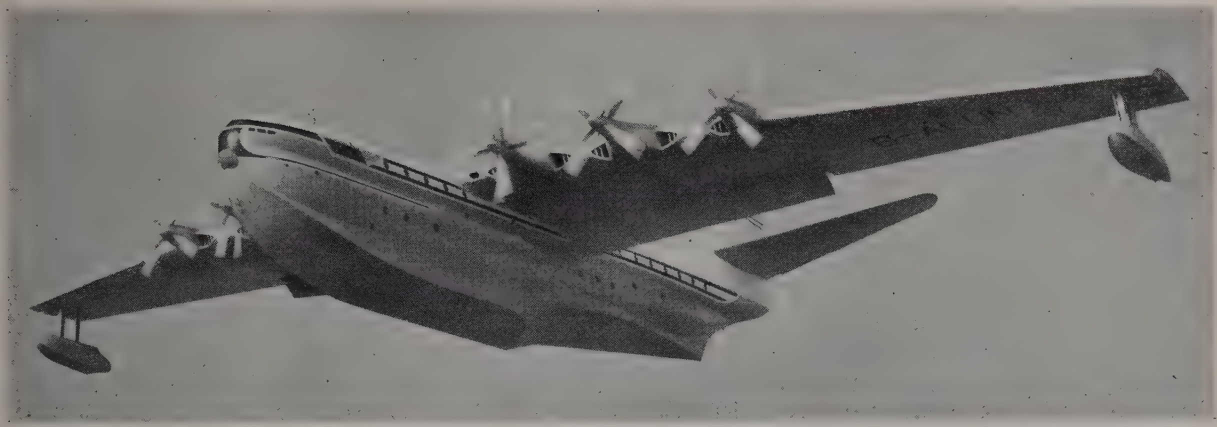
The first Princess, powered by ten Bristol Proteus 600 Series engines was flown for the first time on August 22, 1952.

In 1953 it was confirmed that flight trials, to include pressurised flights at 30,000 ft. (9,150 m.), were to proceed up to a total of 100 hours on the first aircraft. The preliminary flight trial programme was completed in 1954, when it


The Saunders-Roe Princess Long-range Flying-boat.



The Saunders-Roe Princess Long-range Flying Boat (ten Bristol Proteus 600 Series turboprop engines).



The Saunders-Roe Princess Long-range Flying-Boat (ten Bristol Proteus 600 Series turboprop engines).

was decided to suspend further flying until after the installation of more suitable engines. The trials fully justified expectations in all respects.

TYPE.—Long-range Transport Flying-boat.

WINGS.—High-wing cantilever monoplane. Aspect ratio 9.5. All-metal two-spar structure in five main units; centre wing, two inner wings, and two outer wings. Centre wing, span 27 ft. (8.22 m.), chord 30 ft. 9 in. (9.36 m.), integral with hull. Inner wings each of 40 ft. 3 in. (12.95 m.) span, tapering in chord from 30 ft. (9.15 m.) to 26 ft. (7.92 m.). Outer wings each of 51 ft. 6 in. (15.70 m.) span with tip chord of 11 ft. (3.35 m.). Wing thickness at root 5.4 ft. (1.65 m.), at tip 1.3 ft. (0.39 m.). Electrically-operated slotted flaps on centre and inner wings. Electro-hydraulic mechanical power-controlled four-piece ailerons in each outer wing. Thermal anti-icing, to wing leading-edges and air intakes is provided. Gross wing area 5,250 sq. ft. (490.0 m.^{2}).

HULL.—Two-step metal structure. "Double-bubble" arrangement providing two main decks. Hull is pressurised from forward of flight deck to tail breakdown joint aft; pressure differential 8 lb./sq. in. (56.2 kg./m.^{2}). Pressurisation by tappings from main engine compressors. Height of hull 24 ft. 3 in. (7.39 m.), beam 16 ft. 8 in. (5.08 m.), draught 8 ft. (2.44 m.). Retractable wing-tip floats.

TAIL UNIT.—Cantilever monoplane type. Dihedral tailplane. Electro-hydraulic mechanical power-controlled rudder in three sections and elevators in two sections each. Tail-unit thermal anti-icing by self-contained kerosene combustion heaters with independent fuel supply and electric ignition from cockpit. Tailplane span: 77 ft. (23.48 m.). Tailplane chord 22 ft. (6.71 m.) at root, 6 ft. 9 in. (2.06 m.) at tip. Tailplane area: about 1,000 sq. ft. (92.9 m.^{2}). Fin and rudder area about 600 sq. ft. (55.7 m.^{2}).

POWER PLANT.—Ten Bristol Proteus 600 Series turboprop engines in four coupled pairs and two single units in first prototype. It is expected that ultimately ~~six~~ turboprop engines will be installed, three on each wing in similar nacelles. Fuel is carried in two integral tanks in each inner wing between engine bays. Total capacity 14,500 Imp. gallons (65,250 litres).

ACCOMMODATION.—Up to 220 passengers can be carried.

DIMENSIONS.—
Span (wing tip-floats down) 210 ft. 6 in. (64.2 m.).
Span (wing-tip floats up) 219 ft. 6 in. (67.0 m.).
Length 148 ft. 0 in. (45.3 m.).
Height 55 ft. 9 in. (17.0 m.).

WEIGHTS (Designed).—
Weight empty (fully equipped) approx. 171,500 lb. (78,000 kg.).
Payload 50,000 lb. (22,700 kg.).
Weight loaded 345,000 lb. (156,800 kg.).

PERFORMANCE (Estimated).—
Mean cruising speed 358 m.p.h. (576 km.h.).
Max. still-air range 6,040 miles (9,730 km.).

THE SAUNDERS-ROE SKEETER.

The Skeeter was developed by the Cierva company after the war as a small two-seat helicopter for the private owner. The first prototype, powered with a 106 h.p. Jameson engine, flew for the first time on October 8, 1948.

A slightly larger Mk. 2 version, with a 145 h.p. D.H. Gipsy-Major 10 engine mounted athwartships behind the cabin, flew on October 20, 1949.

Mk. 3 and 4 versions, for military and naval use respectively, had been developed when Saro took over the Cierva company. Saro actually took over two Mk. 3's and one Mk. 4.

The two Mk. 3's, were originally powered with the 145 h.p. D.H. Gipsy Major engine but they were later re-engined with the 180 h.p. Cirrus Bombardier engine, with which the Mk. 4 is also powered.

The Mks. 5 and 6 are civil helicopters, the former being powered by a 180 h.p. Cirrus Bombardier engine and the latter by a 200 h.p. D.H. Gipsy Major 30 engine. The specification which follows refers to the Mk. 6, the first example of which flew for the first time on August 29, 1954.

TYPE.—Two-seat light helicopter.

ROTOR SYSTEM.—Three-blade main rotor, fully-articulated hub with drag and flapping hinges. Rotor blades have steel tubular spars, wood ribs and wood and fabric skin. One two-blade anti-torque and steering rotor with solid wood blades. Main rotor blade area 11.95 sq. ft. (1.11 m.^{2}). Main rotor disc area 804 sq. ft. (74.69 m.^{2}). Anti-torque rotor disc area 25 sq. ft. (2.32 m.^{2}).

FUSELAGE.—Steel tubular centre-section, sheet metal fabricated front fuselage, sheet metal monocoque tail boom.

LANDING GEAR.—Tricycle type. Saunders-Roe oleo-spring shock-absorbers. Palmer wheels and tyres. Wheelbase 5 ft. 1 in. (1.55 m.). Track 7 ft. (2.13 m.).

POWER PLANT.—One 200 h.p. de Havilland Gipsy Major 200 four-cylinder in-line inverted air-cooled engine mounted athwartships in fuselage centre-section immediately aft of cabin fireproof bulkhead. Transmission for main rotor through spur reduction gear to intermediate shaft driving final bevel. Tail rotor driven off same intermediate shaft through free-wheel and manually-operated clutch. Main rotor/engine r.p.m. ratio 1 : 7.74. Anti-torque rotor/engine r.p.m. ratio 1 : 1.47. Fuel tank in fuselage forward of fireproof bulkhead. Fuel capacity 23 Imp. gallons (105 litres). Oil tank capacity 3 Imp. gallons (13.5 litres).

ACCOMMODATION.—Cabin seats two side-by-side. Entrance door on each side. Observers' seat reversible in military version.

DIMENSIONS.—
Main rotor diameter 32 ft. (9.76 m.).
Overall length (blades folded) 28 ft. 5 in. (8.66 m.).
Length of fuselage 26 ft. 6 in. (8.10 m.).
Overall width (blades folded) 7 ft. 4½ in. (2.25 m.).
Height over main rotor head 7 ft. 6 in. (2.29 m.).
Tail rotor diameter 5 ft. 8½ in. (1.74 m.).

WEIGHTS AND LOADINGS.—
Tare weight 1,605 lb. (732 kg.).
Disposable load 545 lb. (248 kg.).
Normal all-up weight 2,150 lb. (980 kg.).
Max. all-up weight 2,200 lb. (1,000 kg.).

PERFORMANCE (I.S.A. conditions at normal A.U.W.).—
Max. forward speed at S/L. 106 m.p.h. (172 km.h.).
Max. cruising speed at S/L. 104 m.p.h. (168 km.h.).
Max. rate of climb 1,120 ft./min. (340 m./min.).
Hovering ceiling with ground effect 4,800 ft. (1,460 m.).
Service ceiling 12,300 ft. (3,750 m.).
Absolute ceiling 13,500 ft. (4,110 m.).
Max. endurance at 52 m.p.h. (83 km.h.) at S/L. 3.3 hours.
Max. range at 86 m.p.h. (136 km.h.) at S/L. 238 miles (382 km.).

The Saunders-Roe Skeeter Mk. 6 Helicopter (200 h.p. D.H. Gipsy Major engine.)

SAUNDERS-ROE HYDRO-SKI DEVELOPMENTS.

As part of an extensive research programme into the applications of hydro-skis to aircraft, Saunders-Roe have fitted a set of skis to the normal landing-gear of an Auster J.5G for full-scale tests. The skis enable a land-based aircraft to operate from all types of surface including water, snow and ice. On water the skis will sustain the aircraft only when it is moving, but sufficient lift is given at an acceptable taxying speed. Such a speed can be reached from stand-still in three to four times the aircraft length.

SCOTTISH AVIATION

SCOTTISH AVIATION, LTD.

Head Office and Works: Prestwick Airport, Ayrshire.

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Directors: The Duke of Hamilton, P.C., G.C.V.O., A.F.C., F.R.G.S. (Chairman), Group Captain D. F. McIntyre, A.F.C. (Managing Director), T. D. M. Robertson (General Manager), R. McIntyre, A.F.R.Ae.S. (Chief Engineer), Jackson Millar and H. W. Fulton.

Scottish Aviation Ltd. was formed in 1935 with the object of developing aviation services, and operating flying schools and airports in Scotland. In addition, the Company developed a factory organization, specialising in repair and overhaul of aircraft.

Since the War the first aircraft of original Scottish design and manufacture has been built. This started life as a light military communications aircraft to Specification A.4/45. The original military requirement not having materialised, the basic design was developed into a light transport as the Prestwick Pioneer.

The Pioneer has been supplied to the Royal Air Force under the designation C.C. Mk. 1.

On June 24, 1955, the Twin-Pioneer, a twin-engined double-scale version of the Pioneer, made its maiden flight.

The Prestwick Pioneer C.C. Mk. I (550 h.p. Alvis Leonides engine).

THE PRESTWICK PIONEER.

Type.—Five-seat light Transport, designed for operation from small landing fields.

Wings.—High-wing strut-braced monoplane. Constant chord wing of NACA 4415 section fitted with hydraulically-operated full-span slats and 57.5% span Fowler and split flaps. For take-off, leading-edge slat is open and Fowler flap setting 20°. For landing, the Fowler flap lowers to 30°. The dihedral angle is 1° and incidence 4°. Wing of all-metal, two-spar stressed-skin construction. Wings braced to fuselage by single strut on each side. Fowler flap and slat run in tracks of extruded I-section light alloy and are operated by a system of cables from single jack located in port wing. Ailerons are of metal construction with fabric covering. Flaps and slats are interchangeable port and starboard. Fowler flap area 67.2 sq. ft. (6.25 m.^{2}). Gross wing area 390 sq. ft. (36.2 m.^{2}).

Fuselage.—Alclad stressed-skin construction of basically oval cross-section.

Tail Unit.—Cantilever monoplane type. Construction of tailplane and fin is similar to that of wing. Rudder and elevators are metal with fabric covering, port and starboard elevators being interchangeable. The tailplane is electrically actuated, its incidence being adjustable in flight over a range from +4° to —9°.

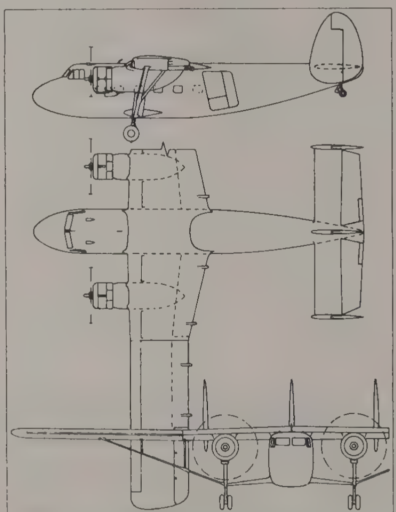
Landing Gear.—Fixed tail-wheel type. Oleo-pneumatic shock-absorber struts. Hydraulic wheel-brakes. Track 9 ft. 8 in. (2.95 m.).

Power Plant.—One 550 h.p. Alvis Leonides 503/7 radial air-cooled engine, supplied as a complete power-plant unit. D.H. three-blade constant-speed airscrew.

Accommodation.—Enclosed cabin seating five in a one-two-two arrangement with the pilot's seat forward on the centre line. The back of the pilot's seat hinges rearwards to facilitate entry and exit. Seats and harness stressed to withstand a deceleration of 25 g. All seats are readily removable and the cabin can be arranged to carry one stretcher and attendant.

Dimensions.—
Span 49 ft. 9 in. (15.16 m.).
Length 34 ft. 7 in. (10.53 m.).
Height (thrust line horizontal) 13 ft. 5 in. (4.09 m.).

Weights and Loadings.—
Weight empty 3,984 lb. (1,806 kg.).
Disposable load 1,816 lb. (823 kg.).
Weight loaded 5,800 lb. (2,630 kg.).
Wing loading at take-off 14.9 lb./sq. ft. (72.7 kg./m.^{2}).
Power loading at take-off 10.38 lb./h.p. (4.7 kg./h.p.).



The Prestwick Twin Pioneer.

Performance (Leonides 503/7 engine).—
Max. speed at 4,250 ft. (1,295 m.) 162 m.p.h. (261 km.h.).
Max. cruising speed at 9,750 ft. (2,970 m.) 151 m.p.h. (342 km.h.).
Max. cruising speed, weak mixture at 11,750 ft. (3,580 m.) 141 m.p.h. (227 km.h.).
Range at 120 m.p.h. at 5,000 ft. (1,525 m.) 420 miles (645 km.).
Take-off distance to 50 ft. (15.2 m.) 230 yds. (210 m.).
Landing distance from 50 ft. (15.2 m.) 200 yds. (182 m.).
Stalling speed with flaps down, engine off 38 m.p.h. (61.5 km.h.).

THE PRESTWICK TWIN PIONEER.

Type.—Twin-engined Transport designed for operation from small landing fields.

Wings.—High-wing braced monoplane. NACA 4415 wing section. Aspect ratio 8.75. Incidence 4°. Light alloy stressed skin structure. Fowler type light alloy flaps. Slotted ailerons have light alloy frames and fabric covering. Total area of flaps 98 sq. ft. (9.10 m.^{2}). Total aileron area 50.8 sq. ft. (4.73 m.^{2}). Gross wing area 670 sq. ft. (62.24 m.^{2}).

Fuselage.—Light alloy stressed-skin structure.

Tail Unit.—Cantilever monoplane type. Light alloy stressed-skin structure. Areas: fins 106 sq. ft. (9.86 m.^{2}), rudder 61 sq. ft. (5.67 m.^{2}), tailplane 113 sq. ft. (10.51 m.^{2}), elevators, 54 sq. ft. (5.02 m.^{2}) Tailplane span: 25 ft. (7.62 m.).

Landing Gear.—Fixed tail-wheel type. Electro Hydraulics, Ltd. shock-absorber struts. Dunlop wheels with hydraulic disc brakes. Track 18 ft. 6 in. (8.69 m.).

Power Plant.—Two 550 h.p. Alvis Leonides 503/8 radial air-cooled engines. DH. 3/2500/3 constant-speed airscrews. Two 55 Imp. gallon (250 litre) and two 30 Imp. gallon (136 litre tanks) in wings outboard of engines. Total fuel capacity 170 Imp. gallons (772 litres). One 7 Imp. gallon (31.7 litre) oil tank in each engine nacelle.

Accommodation.—Pilot and fourteen passengers plus baggage if aircraft fitted with toilet, or sixteen passengers if toilet omitted.

Dimensions.—
Span 76 ft. 6 in. (23.33 m.).

The Prestwick Twin Pioneer (two 550 h.p. Alvis Leonides engines).

The Prestwick Twin Pioneer (two 550 h.p. Alvis Leonides engines).

Length 45 ft. 3 in. (13.80 m.).
Height 13 ft. 3 in. (4.04 m.).
WEIGHTS (Designed).—
Weight empty (16-passenger configuration) 9,075 lb. (4,125 kg.).
Crew (1) plus equipment 185 lb. (84 kg.).
Oil 126 lb. (57 kg.).
Initial en route rate of climb 880 ft./min. (268 m./min.).
Stalling speed, flaps down, engine off 47.5 m.p.h. (76 km.h.).
Range (full load) at 139 m.p.h. (222 km.h.) 565 miles (905 km.).
Take-off distance to 50 ft. (15.25 m.) 342 yds. (313 m.).
Landing distance from 50 ft. (15.25 m.) 294 yds. (270 m.).
Payload plus fuel 4,114 lb. (1,870 kg.).
Max. T.O. and landing weight 13,500 lb. (6,129 kg.).
PERFORMANCE (Estimated).—
Max. weak mixture cruising speed 159 m.p.h. (254 km.h.) at 11,000 ft. (3,355 m.).
Normal cruising speed (50% power) at 5,000 ft. (1,525 m.) 139 m.p.h. (222 km.h.).

SHORT

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Secretary: E. W. A. Woolmer, B.A., C.A.

The firm of Short Brothers, which is the oldest established firm of aircraft designers and producers in the United Kingdom, was founded by the brothers Eustace and Oswald Short in 1898. their work for some years being the manufacture of spherical balloons.

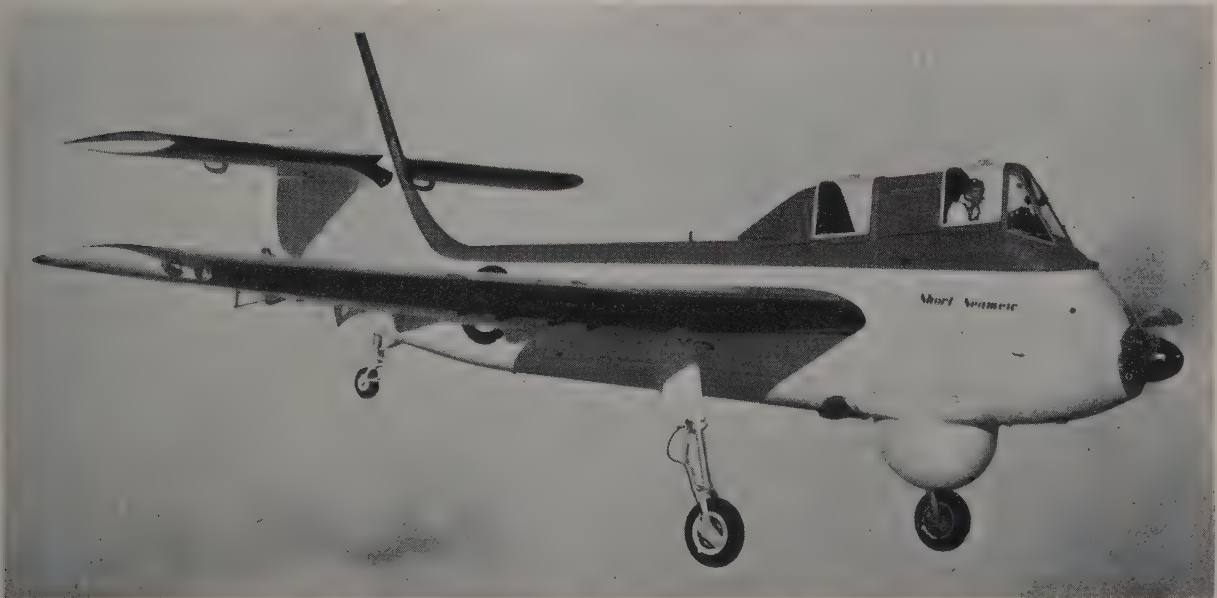
After the first World War, during which various types of naval aircraft were produced, the company pioneered in metal construction and concentrated on the development of the all-metal flying-boat, and many notable designs of both military and civil flying-boats have been built, all of which have been fully illustrated and described in previous editions of "All the World's Aircraft."

In June, 1936, Short Brothers, in collaboration with Harland & Wolff, Ltd. the well-known shipbuilders, formed a new company known as Short & Harland, Ltd. to build aircraft in Belfast.

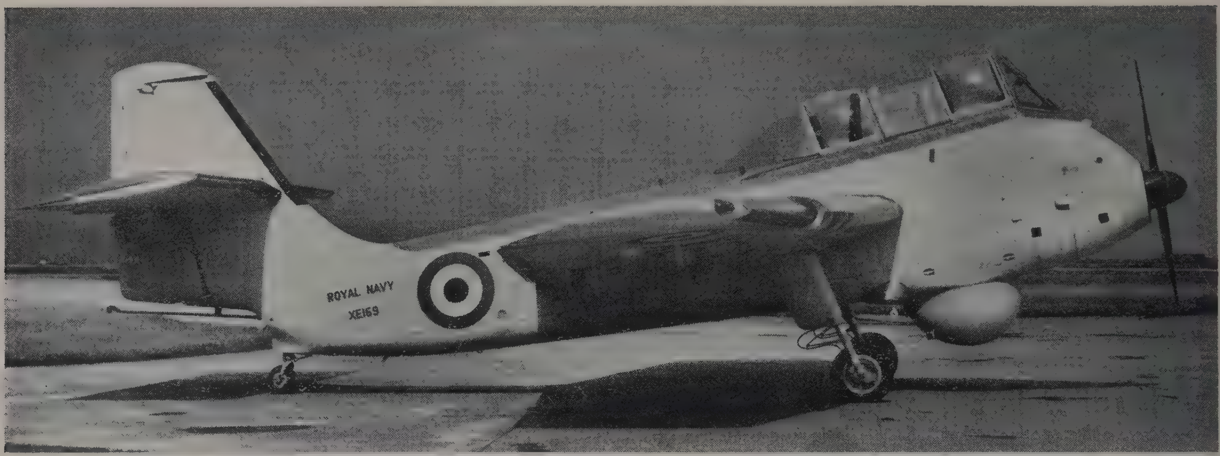
In September, 1947, as a result of Government policy, the company's works at Rochester were closed and all the activities were concentrated at Belfast. Consequently the Rochester company, Short Brothers (Rochester & Bedford) Ltd., and the Belfast company were merged to form Short Brothers and Harland Ltd. of Belfast.

Current Short designs include the S.B.4 Sherpa research monoplane which was built to prove the practical possibilities of the aero-isoclinic wing; the S.B.5 research monoplane which is being used to investigate the characteristics of wings of various degrees of sweepback; and the S.B.6 Seamew, a light anti-submarine aircraft specifically designed for operation from escort carriers and for maritime patrol from small coastal airfields. The Seamew is in production for both the Royal Navy and the Royal Air Force.

Short and Harland are building the



The Short Seamew Light Anti-submarine Monoplane (Armstrong Siddeley Mamba turboprop engine).



The Short Seamew Light Anti-submarine Monoplane (Armstrong Siddeley Mamba turboprop engine).

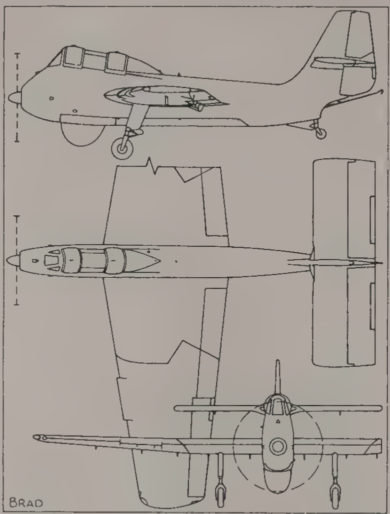
English Electric Canberra jet bomber under direct contract from the Ministry of Supply. The first Short-built Canberra flew for the first time on October 30, 1952.

In December, 1953, Short Brothers and Harland, Ltd. reached an agreement with the Bristol Aeroplane Company, Ltd. to produce the Britannia turboprop airliner at Queen's Island. In 1954 the Bristol Aeroplane Co., Ltd. acquired a small financial interest in Short Brothers & Harland, Ltd. and two directors of the Bristol company were invited to join the Board.

THE SHORT S.B.6 SEAMEW.

The S.B.6 is a light anti-submarine aircraft which has been specifically designed for operation from escort carriers and from small coastal airfields. The first aircraft to be representative of a new trend towards greater simplicity, the Seamew is lighter, cheaper and quicker to produce than any front-line military aircraft designed since the war. It is an all-weather anti-submarine "search and strike" aircraft fully equipped for, and capable of undertaking, all duties designated in the past to more expensive and more complicated aircraft.

The Seamew is a mid-wing monoplane with a fixed tail-wheel landing-gear. The normal crew consists of pilot and navigator, with the pilot positioned well forward for an exceptionally good view in all conditions. Internal stowage is provided for a variety of war stores, including sono buoys, and a radome is installed between the main landing-gear legs. The wings can be power-folded for carrier stowage.



The Short S.B.6 Seamew.

To provide ample elevator and rudder control at the critical landing speed there is a vented fillet in the tailplane and the rudder is horn-balanced. To obtain the best stalling characteristics a small fixed slat has been introduced on the leading-edge of each wing.

The Seamew is in production for the Royal Navy and for Coastal Command, Royal Air Force.

The prototype Seamew, which first flew on August 23, 1953, was powered by an Armstrong Siddeley Mamba ASMa.3 turboprop engine, but production aircraft are being fitted with the more powerful Mamba ASMa.6 engine.

Dimensions.—
Span 55 ft. (16.7 m.).
Width folded 23 ft. (7.0 m.).
Length 41 ft. (12.5 m.).
Height (tail down) 13 ft. 5 in. (4.08 m.).
Height (in flying position) 16 ft. 4 in. (4.98 m.).
Height (tail down, wings folded) 15 ft. 7½ in. (4.76 m.).
Main wheel track 12 ft. 10 in. (3.9 m.).

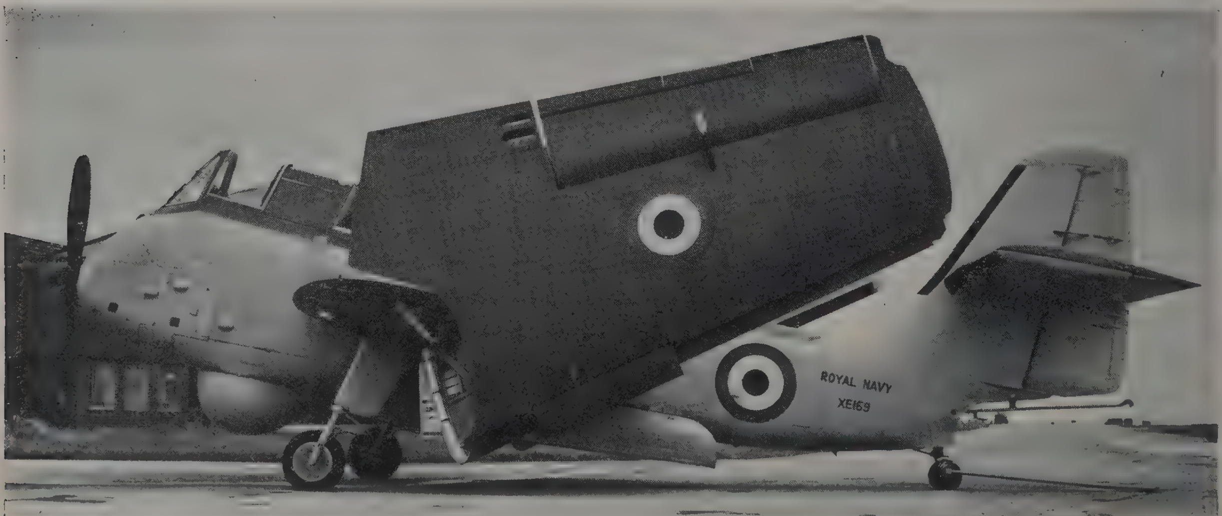
Weight and Performance.—
No data available.

THE SHORT S.B.4 SHERPA.

The S.B.4 is a "private venture" research aircraft which has been built to prove the practical possibilities of the aero-isoclinic wing which was designed by David Keith-Lucas, Short's chief designer. The wing, instead of being stiff, is a relatively flexible structure. The all-moving tips, which comprise about one-fifth of the total wing area, serve as both ailerons and elevators and make it possible to dispense with the normal tailplane and elevators. It is expected that the rotating-tip controls will be markedly superior to flap type controls at transonic speeds and will make the aircraft more manoeuvrable at high altitudes.

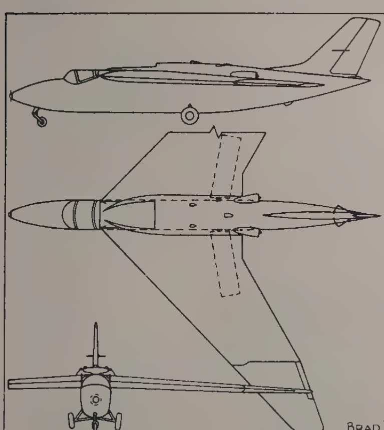
The S.B.4 is not capable of high speeds but the lessons learned from its tests will form the basis of design of future high-speed civil and military aircraft.

Type.—Single-seat twin-jet Research aircraft.



The Short Seamew (Armstrong Siddeley Mamba turboprop engine) with its wings folded.

The Short S.B.4 Sherpa Research Monoplane (Turbomeca Palas turbojet engines).



The Short S.B.4 Sherpa.

WINGS.—Shoulder-wing cantilever monoplane. Piercy 425 wing section. Aspect ratio 5.6. Anhedral 1°. Incidence 1° 49′ at root, —0° 53′ at wing elevon/joint, —6° 4′ at tip. Sweepback 42° 22′. Chord 11 ft. 9 in. (3.58 m.) at root, 5 ft. 7.9 in. (1.73 m.) at joint, 1 ft. 9.9 in. (5.58 m.) at tip. The wing, an aero-isoclinic structure, has a flexural axis located well aft and a torsional stiffness so adjusted that sufficient nose-up twist is provided to cancel out aerodynamic warping due to flexure. To assist in this direction, wing-tip controllers (elevons) are used in place of the usual trailing-edge control. These elevons, which are hinged at 30% of chord, can be rotated either together or in opposition to act as elevators or ailerons respectively. The wing is in one piece attached to the fuselage at three points. Structure mainly of spruce and plywood, light alloy being used in strategic positions. The elevons, of spruce and plywood, are constructed around a built-up metal spar of octagonal section. Electrically-actuated anti-balance tab inset at inboard end of trailing-edge of each elevon. Landing flaps inset in underside of wings. Area of elevons (2) 23.5 sq. ft. (2.183 m.^{2}). Area of anti-balance tabs (2) 3.42 sq. ft. (0.317 m.^{2}). Area of flaps (2) 17.75 sq. ft. (1.648 m.^{2}). Gross wing area 261 sq. ft. (24.25 m.^{2}).

FUSELAGE.—Main or centre position is a stressed-skin structure of light alloy. Tail position is of wood with spruce frames and continuous stringers and plywood bulkheads and skin. Nose portion is of resin-impregnated Fibreglass split horizontally so that upper and lower sections can be easily removed to give access to equipment carried in nose.

TAIL UNIT.—Fin and rudder only. All-wood structure. Areas: fin 9.97 sq. ft. (0.926 m.^{2}), rudder 9.75 sq. ft. (0.905 m.^{2}). Total vertical area 19.72 sq. ft. (1.832 m.^{2}).

LANDING GEAR.—Fixed nose-wheel type. British Messier oleo-pneumatic shock struts. Palmer wheels and tyres. Palmer brakes on main wheels. Small Dunlop tail-wheel in fairing under rear fuselage. Wheelbase 13 ft. 1.45 in. (4.0 m.). Track (main wheels) 4 ft. (1.22 m.).

POWER PLANT.—Two Blackburn Turbomeca Palas turbojet engines (330 lb.=150 kg. s.t. each) mounted side-by-side in upper part of fuselage amidships. Engines inclined outwards 10° to centre-line of fuselage. Flush air intake in deck of fuselage. Jet pipes emerge from sides of fuselage just aft of wing trailing-edge. Fireproof bulkheads fore and aft and sheet steel floor isolate engine bay. Main fuel (kerosene) in two tanks (25 Imp. gallons= 113.5 litres each) in fuselage below engine bay. Two recuperators carry petrol (0.50 Imp. gallons=2.27 litres each) for starting. Oil tank between engines.

ACCOMMODATION.—Single enclosed cockpit.

DIMENSIONS.—
Span 38 ft. (11.59 m.).
Length 32 ft. 4½ in. (9.87 m.).
Height 9 ft. 1 in. (2.77 m.).

WEIGHTS AND PERFORMANCE.—
No data available.

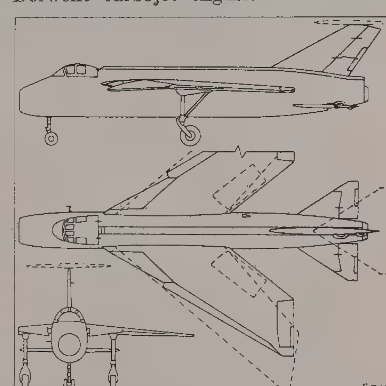
THE SHORT S.B.5.

The S.B.5 is a research aircraft which was designed and built at the request of the Ministry of Supply for the investigation of problems associated with the low-speed handling characteristics of swept-back wings.

The S.B.5 was designed so that varying degrees of sweepback can be tested. The tailplane can also be positioned either at the extreme top of the fin or beneath the rear fuselage and its angle of incidence is variable.

The varying degrees of sweep-back angle are achieved by fitting alternative components and four configurations can be tested. These are 50° wing sweepback with high tail-unit; 60° sweepback with low tail-unit; 60° sweepback with high tail-unit; and 69° sweepback with high tail-unit. The angle of incidence of the tailplane can be varied in flight from 10° above to 10° below the horizontal. The position of the non-retracting nose-wheel landing-gear can be changed to enable each configuration to be tested at various C.G. positions.

The S.B.5 is powered by a Rolls-Royce Derwent turbojet engine. It is mainly



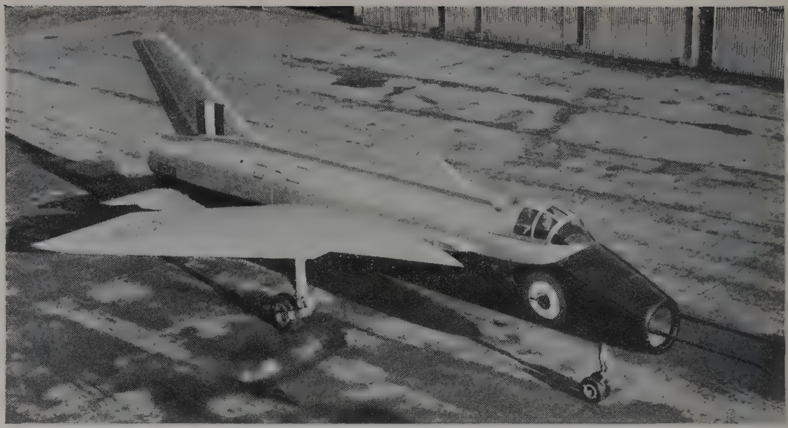
The Short S.B.5.

The Short S.B.5 with 60° wing sweepback and high tail.

of all-metal construction, the leading and trailing-edges of the wings being plywood-covered. The pilot's cockpit, which is forward of the wings, is provided with an ejector seat. Anti-spin and braking parachutes are fitted.

The S.B.5, which has completed a series of tests with 50° and 60° sweepback—in the latter configuration with both high and low set tailplane—was responsible for all the low-speed research carried out in the development of the English Electric P.1 transonic fighter.

DIMENSIONS.—
- Span (50° configuration) 35 ft. 2¼ in. (10.74 m.).
- Span (60° configuration) 30 ft. 6 in. (9.30 m.).
- Span (69° configuration) 25 ft. 11¾ in. (7.92 m.).
- Overall length 47 ft. 4 in. (14.43 m.).
- Max. Height (high tailplane) 16 ft. 7 in (5.0 m.).
- Max. height (low tailplane) 15 ft. (4.57 m.).



The Short S.B.5 with 60° wing sweepback and low tail.

SLINGSBY

SLINGSBY SAILPLANES, LTD.

HEAD OFFICE AND WORKS: KIRBYMOORSIDE, YORKSHIRE.

Directors: F. N. Slingsby, M.M., A.F.R.Ae.S. (Managing), Major J. E. D. Shaw, Lieut-Col. G. R. D. Shaw, G. E. Shaw, G. Dixon, J. R. H. Shaw.

The Slingsby Type 34 Sky Single-seat Sailplane.

THE SLINGSBY TYPE 34 SKY.

The Type 34 high-performance sailplane was specially designed to make an all-British design available for national and international gliding contests.

In the 1952 International Gliding Championships, the British team won first and third places in the single-seat class flying Sky sailplanes. Other nations flying the Sky in that contest were the Argentine Republic and Holland.

The Slingsby Skylark 2 Sailplane.

TYPE.—High-performance contest sailplane.

WINGS.—High-wing cantilever monoplane. Single-spar, torsion-resisting nose-box structure with light secondary spar to carry two-piece ailerons. Wood construction. Fabric covered aft of main spar. D.F.S.-type dive brakes. Gross wing area 187 sq. ft. (17.4 m.²). Standard mean chord 3.165 ft. (0.96 m.). Aspect ratio 18.65 : 1.

FUSELAGE.—Ply-covered stressed-skin structure.

TAIL UNIT.—Cantilever tailplane. Fabric covered rudder and elevator. Span 9.9 ft. (3.01 m.).

LANDING GEAR.—Mono-wheel type, with single landing wheel terminating a single centrally-placed ash skid beneath forward fuselage. Alternatively, a jettisonable two-wheel dolly may be used. Ash tail skid.

ACCOMMODATION. — Single-seat cockpit immediately forward of wing leading-edge, with one-piece moulded Perspex canopy.

DIMENSIONS.—
- Span 59.06 ft. (18 m.).
- Length 24.875 ft. (7.585 m.).

WEIGHTS AND LOADINGS.—
- Empty weight 549.5 lb. (250 kg.).
- Disposable load 250 lb. (113.5 kg.).
- All-up weight 800 lb. (364 kg.).
- Wing loading 4.29 lb./sq. ft. (21 kg./m.²).

PERFORMANCE.—
- Sinking speed at 39 m.p.h. (62.9 km.h.) 2 ft./sec. (0.61 m./sec.).
- Gliding angle at 46 m.p.h. (74 km.h.) 1 in 30.

THE SLINGSBY TYPE 41 SKYLARK 2.

TYPE.—Single-seat Sailplane.

WINGS.—High-wing cantilever monoplane. Wing sections NACA $63_3$620 at root, NACA 4415 at tip. Aspect ratio 16 : 1. Chord 42 in. (1.06 m.) at root, 23 in. (0.58 m.) at tip. Dihedral 2°. Incidence 5° at root. All-wood structure comprising main spar and light rear spar, plywood covering to rear spar of fabric-covered trailing-edge. Plain plywood-covered ailerons. Total aileron area 17.94 sq. ft. (1.66 m.²). Gross wing area 144 sq. ft. (13.37 m.²).

FUSELAGE.—Semi-monocoque elliptical-section structure with spruce frames and plywood skin.

TAIL UNIT.—Cantilever monoplane type. All-wood framework with plywood-covered fin and tailplane of fabric-covered rudder and elevators. Areas: fin 7.38 sq. ft. (0.68 m.²), rudder 7.5 sq. ft. (0.70 m.²), tailplane 12.6 sq. ft. (1.17 m.²), elevators 9.95 sq. ft. (0.92 m.²). Span of tail 9 ft. 3½ in. (2.82 m.).

LANDING GEAR.—Central skid and main landing wheel, and small tail-skid at base of rudder-post.

ACCOMMODATION.—Single enclosed cockpit. Back-type parachute.

DIMENSIONS.—
- Span 48 ft. (14.64 m.).
- Length 24 ft. 6 in. (7.47 m.).
- Height 5 ft. (1.52 m.).

WEIGHTS.—
- Weight empty 444 lb. (201.5 kg.).
- Weight loaded 680 lb. (309 kg.).

PERFORMANCE.—
- Best glide ratio 27.8 : 1 at 43 m.p.h. (68.8 km.h.).
- Min. sinking speed 2.3 ft./sec. (0.7 m./sec.).
- Speed at sink of 6 ft./sec. (1.8 m./sec.) 73.3 m.p.h. (117.2 km.h.).
- Min. speed at max. weight 36.7 m.p.h. (58.7 km.h.).

THE KIRBY TUTOR.

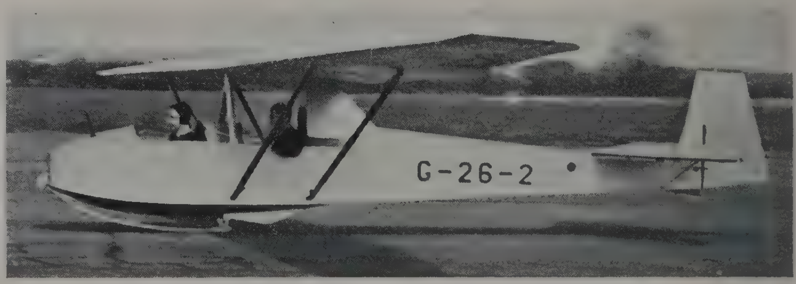
The Tutor is a secondary type sailplane which was evolved from the earlier Kirby Cadet by the fitting of a tapered wing of higher aspect ratio and the incorporation of a differential mechanism in the aileron control circuit.

DIMENSIONS.—
- Span 43 ft. 3¾ in. (13.2 m.).
- Other dimensions as for Cadet.

WEIGHTS.—
- Weight empty 355 lb. (162 kg.).
- Weight loaded 570 lb. (260 kg.).
- Wing loading 2.98 lb./sq. ft. (14.6 kg./m.²).

THE SLINGSBY TYPE 31 TANDEM TUTOR.

This is another development of the Tutor intermediate type sailplane. It has been specially designed to make a low-priced



The Slingsby Type 31 Tandem Tutor.

dual-control glider available for training purposes. Most of the components are interchangeable with those of the solo Tutor, saving jig and tool costs and simplifying stores. The flying characteristics of the Tutor and Tandem Tutor are almost identical, so that the *ab initio* pilot can graduate from one to the other with ease.

DIMENSIONS.—
Span 43 ft. 4⅝ in. (13.2 m.).
Gross wing area 170 sq. ft. (15.8 m.^{2}).
Standard mean chord 3.94 ft. (1.2 m.).
Aspect ratio 11 : 1.

WEIGHTS.—
Tare weight 389 lb. (176.5 kg.).
Disposable load 360 lb. (164 kg.).
All-up weight 750 lb. (341 kg.).

PERFORMANCE.—
Sinking speed at 36 m.p.h. (58 km.h.) 3.4 ft./sec. (1.02 m./sec.).
Gliding angle at 45 m.p.h. (73 km.h.) 18.5 to 1.
Stalling speed 32 m.p.h. (51.5 km.h.).

The Slingsby Type 21B Sedbergh TX. Mk. I Training Glider.

THE SLINGSBY TYPE 21B SEDBERGH.

The Type 21B is a two-seat side-by-side training glider which has been designed to meet the requirements for a simple type of dual instruction sailplane of medium performance and low price, suitable for gliding clubs and other training organizations.

The Type 21B is in service with the R.A.F. Reserve Command and the Air Training Corps. In its service form it is named the Sedbergh TX Mk. 1.

TYPE.—Two-seat Training Glider.

WINGS.—High-wing braced monoplane. Single-spar torsion-resisting nose-box structure with light secondary spar to carry ailerons. Wood construction with fabric covering aft of main spar. Single bracing struts on each side. Standard mean chord 4 ft. 9⅞ in. (1.47 m.). Aspect ratio 11.2. Gross wing area 260 sq. ft. (24.15 m.^{2}).

FUSELAGE.—Of mixed construction. Forward portion back to two main wing attachment-frames of wood stressed skin construction, remainder of fabric-covered girder construction.

TAIL UNIT.—Braced tailplane. Rudder and elevators are fabric-covered. Span 12 ft. 6⅜ in. (3.67 m.).

LANDING GEAR.—Single central skid followed by single wheel. Spring tail-skid.

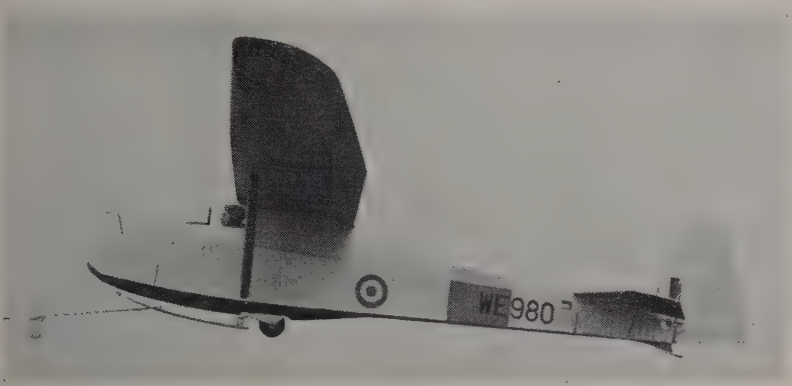
ACCOMMODATION.—Open cockpit seating two side-by-side with dual controls. Provision for back-type parachutes. Two control columns and dual rudder pedals. Quick-release and lift-spoiler controls placed centrally.

EQUIPMENT.—Instruments include A.S.I., Kollsman sensitive altimeter, Cobb-Slater variometer and Pullen electric turn-and-bank indicator. "Ottfur" type towing attachment mechanism.

DIMENSIONS.—
Span 54 ft. (16.47 m.).
Length 26 ft. 8 in. (8.13 m.).

WEIGHT EMPTY.—
608 lb. (280 kg.).

PERFORMANCE.—
Best gliding angle 1 in 21 at 42 m.p.h. (67.2 km.h.).
Min. sinking speed 2.8 ft./sec. (0.85 m./sec.) at 38 m.p.h. (60.8 km.h.).
Stalling speed 28 m.p.h. (41.6 km.h.).



The Slingsby Type 30 Prefect TX. Mk. I Sailplane. (*The Aeroplane*).

THE SLINGSBY TYPE 30 PREFECT.

The Prefect is an intermediate type of sailplane in the semi-aerobatic category which was designed for use by civilian or service training organisations. It is suitable for cloud flying and cross-country flights, and includes among its equipment an airspeed indicator, sensitive altimeter, variometer, compass and electrical turn and bank indicator. Dive-brakes are a standard fitting. It is used by the R.A.F. as the Prefect TX. Mk. 1.

DIMENSIONS.—
Span 45 ft. (13.75 m.).
Length 20 ft. 8 in. (6.3 m.).
Height 4 ft. 2 in. (1.275 m.).
Max. wing chord 3 ft. 0½ in. (0.918 m.).
Tailplane span 9 ft. 2½ in. (2.8 m.).

WEIGHTS.—
Weight empty 390 lb. (177 kg.).

PERFORMANCE.—
Best gliding angle 1 in 21.
Min. sinking speed 2.6 ft./sec. (0.792 m. sec.).
Best flying speed 40 m.p.h. (64.6 km.h.).

SUPERMARINE

VICKERS-ARMSTRONGS (AIRCRAFT) LTD. (Supermarine Division).

WORKS: HURSLEY PARK, WINCHESTER, HANTS, AND SOUTH MARSTON, SWINDON, WILTS.

LONDON OFFICE: VICKERS HOUSE, BROADWAY, WESTMINSTER, S.W.1.

Directors: See under "Vickers."

Superintendent (Supermarine Division): S. P. Woodley, M.B.E.

Chief Designer (Supermarine Division): J. Smith, C.B.E., F.R.Ae.S., A.M.I. Mech.E.

The original Supermarine Company was formed in 1912 and its efforts were chiefly devoted to the production of sea-going aircraft. The firm is famous for the design and production of the high-speed seaplanes which were successful in the Schneider Trophy Contests of 1927, 1929 and 1931, thus winning the Trophy outright for Great Britain. These seaplanes were also responsible for several World's Speed Records, and the last was made on September 29, 1931, when the winning S.6B, fitted with a special Rolls-Royce "sprint" engine, raised the Record to 407.5 m.p.h. (655.8 km.h.).

In November, 1928, Vickers (Aviation) Ltd. took over the control of the Supermarine Aviation Works, Ltd. In October, 1938, the Supermarine Aviation Works (Vickers), Ltd., was, with its parent company Vickers (Aviation), Ltd., taken over by Vickers-Armstrongs, Ltd.

On January 1, 1955, a new Vickers-Armstrongs subsidiary, Vickers-Armstrongs (Aircraft), Ltd., took over the aircraft business previously carried on by the parent company.

Supermarine's first landplane to go into production was the Spitfire, which first flew in 1936. Total production of the Spitfire, of which some twenty-nine different versions were built during the war, amounted to 21,767, including naval Seafires and 305 Spitfires built before the war.

The naval version of the Spitfire, known as the Seafire, went into service with the Fleet Air Arm in 1942. The final version was the Mk. 47.

On the marine side, Supermarine has built the Walrus, Sea Otter and Seagull, all single-engined amphibian flying-boats. The first two were produced in quantities and both were employed mainly on Air/Sea Rescue duties. The Seagull did not go into production.

Supermarine's first jet-propelled fighter, the Attacker, was supplied in numbers to the Royal Navy. A swept-wing version, the Type 510, was built for experimental purposes, and the Type 535 was a further development. This latter model was succeeded by the Swift, which is now in production for the Royal Air Force.

THE SUPERMARINE SWIFT.

The Swift is a single-seat swept-wing fighter powered by the Rolls-Royce Avon axial-flow turbojet engine.

On July 10, 1952, the prototype Swift established an international point-to-point record between London and Brussels, covering the distance of 200 miles (320 km.) in 18 min. 3.3 sec., representing a speed of 665.9 m.p.h. (1,065.4 km.h.).

On July 5, 1953, a Swift Mk. 4 flew from London to Paris in 19 min. 5.6 sec. and back to London in 19 min. 14.3 sec. These times represent speeds of 669.3 m.p.h. (1,077 km.h.) and 664.3 m.p.h. (1,069.3 km.h.), respectively, over the 212.5 miles between the two capitals.

On September 25, 1953, a Swift Mk. 4 raised the World's Speed Record to 735.7 m.p.h. (1,184 km.h.) over a 3-km. course at Castel Idris, Libya. This record was homologated by the F.A.I. but was short-lived.

The following versions of the Swift have been built:—

Swift F. Mk. 1. Rolls-Royce Avon turbojet engine. Day interceptor fighter. Armament: two 30 mm. Aden cannon.

The Supermarine Swift F.R. Mk. 5 Fighter Reconnaissance Monoplane (Rolls-Royce Avon turbojet engine).

First Mk. 1 flew for the first time on August 25, 1952.

Swift F. Mk. 2. Interim development of the Mk. 1. Armament increased to four 30 mm. cannon. New wing plan-form with compound leading-edge taper.

Swift F. Mk. 3. Development of Mk. 2 with Rolls-Royce Avon RA.7R engine with afterburner. Changes to rear end of fuselage to accommodate larger tail-pipe.

Swift F. Mk. 4. Similar to Mk. 3 but fitted with all-moving tail. Single fence on each wing. Slightly increased fin area. Armament: four 30 mm. Aden cannon.

Swift F.R. Mk. 5. Fighter reconnaissance version. Longer nose with slightly modified outline to accommodate camera equipment.

Of the above versions of the Swift, Mks. 1, 2 and 3, of which about 60 in all were built, will not be used operationally. A limited number of the Swift Mk. 4 will be completed but production of the Mk. 5 continues.

The only details of the Swift available for publication at the time of going to press are as follow.

Type.—Single-seat Ground Attack Fighter, or Fighter-Reconnaissance monoplane.

Wings.—Low-wing cantilever monoplane. 40° sweepback at 25% chord line. All-metal structure. Gross wing area 306 sq. ft. (28.43 m.^{2}).

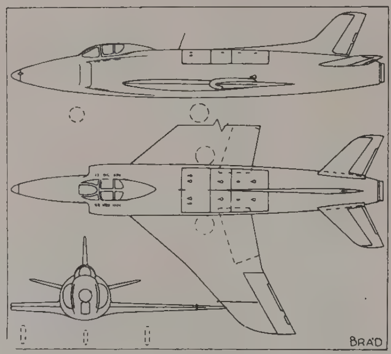
Fuselage.—All-metal structure.

Tail Unit.—Cantilever monoplane type. All surfaces swept back. Tailplane span 12 ft. 11 in. (3.93 m.).

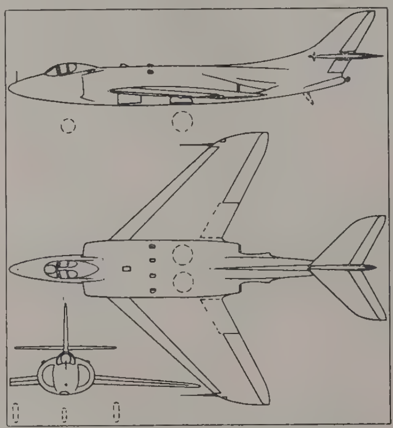
Landing Gear.—Retractable nose-wheel type. Hydraulic retraction. Wheel track 15 ft. 2½ in. (4.64 m.). Wheelbase 14 ft. 10 in. (4.52 m.).

Power Plant.—One Rolls-Royce Avon axial-flow turbojet engine with afterburner.

Accommodation.—Single-seat cockpit. Jettisonable canopy. Ejection seat.



The Supermarine Swift F. Mk. 4.



The Supermarine Type 525.

Dimensions.—
Span 32 ft. 4 in. (9.86 m.).
Length 41 ft. 5½ in. (12.63 m.).
Height 13 ft. 6 in. (4.11 m.).

THE SUPERMARINE N. 113.

In 1953 it was announced that the Admiralty had placed an order for a substantial quantity of twin-jet swept-wing fighters developed from the Type 508. The Type 525 represented an interim stage in the development of the production aircraft, at present known as the N.113, which had been designed to carry guided weapons. No other details are available, but brief details of the Types 508 and 525 follow.

THE SUPERMARINE TYPE 525.

The Type 525 was an experimental twin-jet swept-wing carrier fighter which had been developed from the Type 508. Like the Type 508 it was powered by two Rolls-Royce Avon turbojet engines.

The Type 525 was fitted with a "super-circulation" or "blown-flap" system, wherein air bled from the engine compressors was blown over the upper surface of the wing flaps to lower the stalling speed.

The Type 525 made its first flight from Boscombe Down on April 28, 1954, but after a considerable amount of development flying was destroyed in an accident on July 5, 1955. No other details are available.

THE SUPERMARINE TYPE 508.

The Type 508 was, at the time of its debut, the most powerful fighter ever designed for aircraft-carrier operations. It made its first flight on August 31, 1951, and successfully completed its carrier trials in H.M.S. *Eagle* in May, 1952.

The Type 508 represented the first stage in the development of the N.113 twin-jet supersonic swept-wing fighter which has been ordered by the Royal Navy.

Dimensions.—
Span 41 ft. (12.5 m.).
Length 50 ft. (15.25 m.).
Height 11 ft. 7½ in. (3.54 m.).
Width folded 20 ft. (6.1 m.).

The Supermarine Type 525 Single-seat Naval Fighter (two Rolls-Royce Avon turbojet engines).

VICKERS

VICKERS-ARMSTRONGS (AIRCRAFT) LTD.

Aviation Works : Weybridge, Surrey.

London Office : Vickers House, Broadway, Westminster S.W.1.

Directors : Major-General C. A. L. Dunphie, C.B., C.B.E., D.S.O. (Chairman); G. R. Edwards, C.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E. (Managing Director) ; J. Anderson ; T. Gammon, O.B.E., M.I.Mech.E. ; E. J. Waddington, A.C.A. ; and R. P. H. Yapp.

Chief of Aeronautical Research and Development : B. N. Wallis, C.B.E., F.R.S., R.D.I., B.Sc. (Hon.), M.Inst. C.E., F.R.Ae.S.

Chief Designer, Aircraft : B. Stephenson, A.F.R.Ae.S.

Chief Designer, Guided Weapons : H. H. Gardner, B.Sc., F.R.Ae.S.

Manager and Works Administrator : R. Edmonds, M.B.E.

Works Superintendent : T. Parker.

Vickers (Aviation), Ltd. was formed in July, 1928, when Vickers, Ltd. formed their Aviation Department into a separate subsidiary company to take over the manufacture of aircraft, aircraft accessories and equipment. In November, 1928, Vickers (Aviation), Ltd. took over the control of the Supermarine Aviation Works, Ltd.

In October, 1938, Vickers (Aviation), Ltd. and the Supermarine Aviation Works (Vickers), Ltd. were taken over by Vickers-Armstrongs, Ltd.

In December, 1954, as part of a re-organisation of Vickers-Armstrongs, Ltd., a new subsidiary company known as Vickers-Armstrongs (Aircraft) Ltd. was formed to acquire the aircraft business which was at that time carried on at Weybridge, Supermarine and other works. The take-over took place on July 1, 1955, although the acquisition was back-dated to January 1, 1955. The Board of Directors of the new company is as above.

Vickers aircraft were operated in the 1914-18 War and subsequently have covered a wide range of types in both military and civil spheres.

The first post-war production of Vickers-Armstrongs Weybridge Works was the V.C.1 Viking, which was produced in large numbers for use by airlines of many nations. Military versions of the Viking, the Valetta military transport and the Varsity crew trainer, have been built for the Royal Air Force.

The latest civil aircraft to be developed by Vickers-Armstrongs is the Viscount. The Viscount was the first civil airliner powered with turboprop engines to fly. It was also the first turboprop-powered airliner to go into regular service.

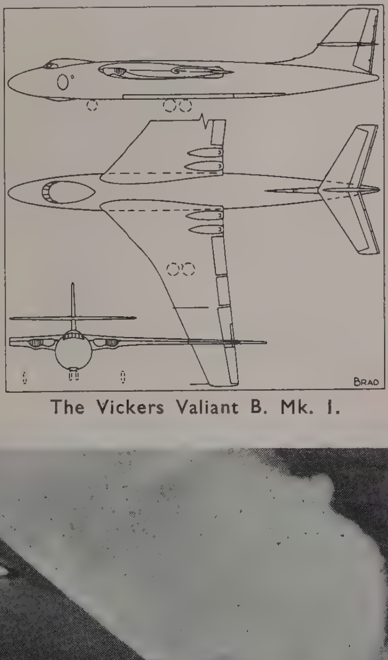
British European Airways began regular Viscount services in April, 1953. In the course of their normal operations they have established over forty official airline route records.

Air France, began operating Viscounts in 1953, Aer Lingus (Irish Airlines) and Trans-Australia Airlines inaugurated their Viscount services in 1954, while Trans-Canada Airlines, British West Indian Airways, Hunting-Clan Air Transport and others put Viscounts into service in 1955. Many other overseas airlines will be taking delivery of Viscounts in 1955 and 1956. A full list of airlines and other agencies which have ordered Viscounts appears elsewhere.

The latest Vickers military aircraft is the Valiant, the first four-jet bomber to go into service in the Royal Air Force.

THE VICKERS TYPE 1000.

The Type 1000 has been ordered as a military transport. This aircraft will be a low-wing monoplane with a wing form similar to that of the Valiant. It will be powered by four Rolls-Royce Conway by-pass turbojet engines buried in the wings. The Type 1000 is intended for operation over very long distances at high subsonic speeds. No further details are available for publication.



The Vickers Valiant B. Mk. I.

Dimensions (approx.).—
Span 140 ft. (42.67 m.).
Length 146 ft. (44.5 m.).
Height 38 ft. 6 in. (11.73 m.).

THE VICKERS TYPE 674 VALIANT.

The Valiant is a four-jet high-performance swept-wing bomber which is in "super-priority" production for the Royal Air Force. It is powered by four Rolls-Royce Avon turbojet engines. The first prototype flew for the first time on May 18, 1951, and the second prototype made its maiden flight on April 11, 1952.

The mention of two versions of the Valiant is permitted. These are :—

Valiant B. Mk. 1. Two Rolls-Royce Avon RA.14 engines. First production model. Outward-retracting twin-wheel main landing-gear units.

Valiant B. Mk. 2. Developed from Mk. 1. Backward-retracting eight-wheel bogie landing-gear units housed, when retracted, in fairings extending beyond wing trailing-edge. Longer fuselage nose. Flew for the first time on September 4, 1953.

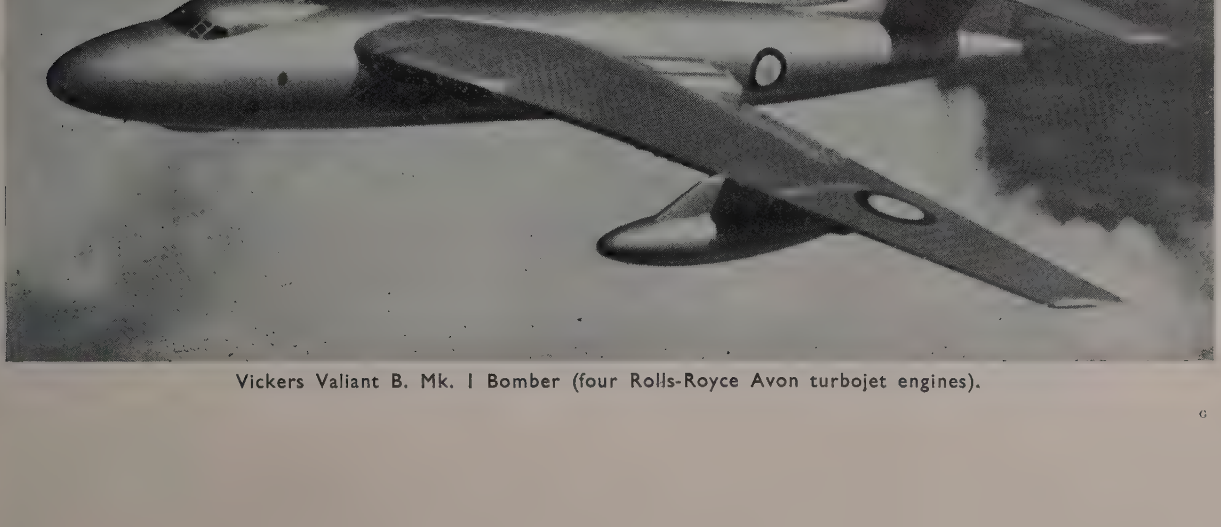
The Valiant B. Mk. 1 went into R.A.F. squadron service in 1955.

No further details of the Valiant were available for publication at the time of writing.

THE VICKERS VISCOUNT 700 SERIES.

The original design concept of the Viscount as a 24-passenger airliner began in 1945 at a time when the Rolls-Royce Dart engine was expected to develop about 800 s.h.p. When, however, the Dart reached practical form it was found that it could yield at least 1,000 s.h.p. The decision was then made to build the first Viscount, the Type 630, as a 32-passenger aircraft, and this prototype powered by four 1,000 s.h.p. Dart 502 engines, and famous as being the first civil airliner to be powered by turboprop engines, made its maiden flight on July 16, 1948.

In 1949 the construction of a second Viscount, the Type 700, was started. By this time the Dart 504 was developing 1,400 s.h.p. and in consequence it was possible to "stretch" the aircraft to accommodate 40-48 passengers. The fuselage was lengthened by 6 ft. 8 in. (2.03 m.) and the overall wing span was increased by 5 ft. (1.525 m.). The prototype 700 flew for the first time on August 28, 1950.



Vickers Valiant B. Mk. I Bomber (four Rolls-Royce Avon turbojet engines).

The Vickers Viscount (four Rolls-Royce Dart turboprop engines) in the colours of Trans-Canada Air Lines.

In November, 1953 the Dart 506 engine was announced. This engine gives an additional 80-90 horsepower under cruising conditions which results in an average increase in cruising speed of 18 m.p.h. (29 km.h.) at a reduced specific fuel consumption. All Type 700 aircraft fitted with the Dart 506 are now cleared for an all-up weight of 60,000 lb. (27,240 kg.). They can also be modified to take the later 1,600 s.h.p. Dart 510 engine if required.

In July, 1954 the Viscount 700D was announced. This version has the same airframe as the 700 but is fitted with four 1,600 s.h.p. Dart 510 engines, has increased fuel capacity (1,950 Imp. gallons=8,850 litres) and an increased take-off weight (60,000 lb.=27,240 kg.) and landing weight (54,000 lb.=24,520 kg.).

A long-range version of the 700D is available with a maximum take-off weight of 62,000 lb. (28,150 kg.). This has a 145 Imp. gallon (660 litre) slipper tank fitted under each wing outboard of the outer engine nacelles. The sixth aircraft delivered to Trans-Australia Airlines was the first Viscount to be fitted with slipper tanks.

Type 701. Four Rolls-Royce Dart 505 (early aircraft) or 506 (later aircraft) turboprop engines. Twenty-seven for British European Airways. First production 701 flew on August 20, 1952. B.E.A. inaugurated the World's first turboprop-powered passenger services with Viscount on April 18, 1953.

Type 702. Four for British West Indian Airways. 44-53 passenger configuration. A.U.W. 58,500 lb. (26,560 kg.).

Type 707. Four Rolls-Royce Dart 505 engines. Four for Aer Lingus (Irish Air Lines). 48 passengers. A.U.W. 57,000 lb. (25,880 kg.).

Type 708. Four Rolls-Royce Dart 505 engines. Twelve for Air France. A.U.W. 57,000 lb. (25,880 kg.).

Type 720. Four Rolls-Royce Dart 505 or 506 engines. Eight for Trans-Australia Airlines, first five with Dart 505 engines and last three with Dart 506 engines and slipper-type long range tanks.

Type 723. One for Indian Air Force. 48-passenger transport.

Type 724. Four Rolls-Royce Dart 506 engines. Fifteen for Trans-Canada Air Lines. Have special provisions for cold weather flying, including additional heating for passenger, crew and baggage compartments, increased electrical power, etc. Remaining ten of T.C.A. fleet are Type 757 (which see).

Type 730. One for Indian Air Force. V.I.P. transport for 18 passengers.

Type 732. Three for Hunting-Clan Air Transport, Ltd. 53-59 passenger layout. Two further aircraft (700 D), ordered in November, 1954, are Type 759 (which see).

Type 734. One V.I.P. aircraft for Pakistan Government for use of Governor-General.

Type 735. Three for Iraqi Airways. 44-48 passenger layout.

Type 736. Two for Fred Olsen's Flyselskap A/S (Norway). 44-57 passenger layout. On two-year lease to B.E.A.

Type 737. One for Canadian Department of Transport.

Type 739. Three for Misrair S.A.E. (Egypt).

Type 742. One (700D) for Braathen's S.A.F.E. (Norway).

Type 744. First three for Capital Airlines, ordered in June, 1954, are of this type. Are modifications of Type 701 made available from B.E.A. production.

Type 745. Fifty-seven for Capital Airlines. Of these aircraft, first eleven will have Dart 506 engines, remainder will be 700D's with Dart 510 engines.

The Vickers Viscount Airliner (four Rolls-Royce Dart turboprop engines).

Type 747. Two for Butler Air Transport, Ltd. (Australia). Option for further four.

Type 748. Five (700D) for Central African Airways Corporation.

Type 749. Three for Linea Aeropostal Venezolana.

Type 755. Three for Airwork, Ltd.

Type 757. Ten for Trans-Canada Air Lines. Balance of order for a total of twenty-five; first ten being of Type 724 (which see).

Type 759. Two (700D) for Hunting-Clan Air Transport, Ltd. Balance of order for five, first three being of Type 732 (which see).

Type 760. Two (700D) for Hong Kong Airways.

Type 761. Three for Union of Burma Airways.

Type 762. Three (700D executive type) for United States Steel Corporation. Will be special long-range aircraft with two wing slipper tanks (145 Imp. gallons=660 litres) and one fuselage "belly" tank (450 Imp. gallons=2,040 litres). Furnishings will be installed in the United States.

Type 763. One (700D) for Howard Hughes Tool Company of Delaware, U.S.A. Similar internal layout to Type 745, but furnishings supplied in United States. Will be used for study and analysis of turboprop-powered aircraft.

Type 765. One (700D executive type) for Standard Oil Company of California.

Type 766. One (700D) for Fred Olsen's Flyselskap A/S., Norway.

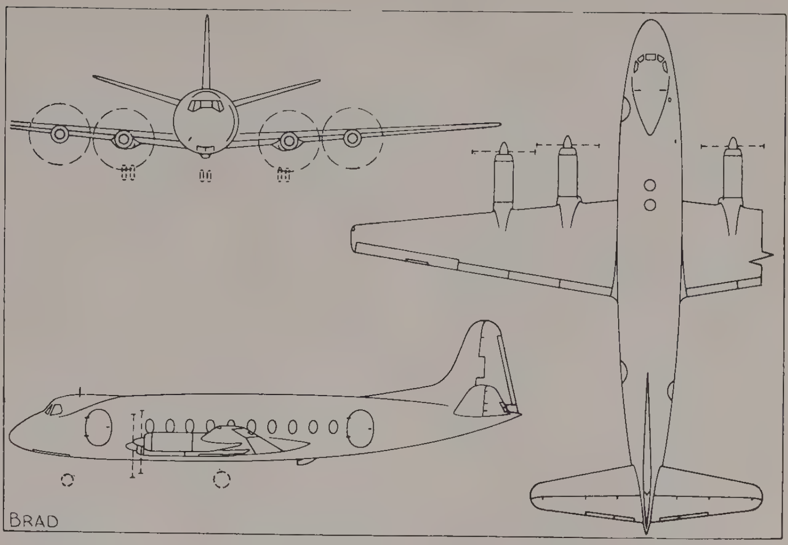
Type 767. Twelve (700D) ordered by B.O.A.C. for use of associated companies, mainly in Middle East.

The latest orders for Viscounts announced at the time of closing for press were for five 700D's for the Indian Airways Corporation and a repeat order for two 700D's for Trans-Australia Airlines.

The description below refers to the Viscount 700 Series in general.

TYPE—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Aerofoil section NACA 63 modified. Aspect ratio 9.17. All-metal structure with stressed Alclad skin. Double-slotted flaps between Irving-type ailerons and fuselage. Thermal de-icing. Root chord 14 ft. 10 in. (4.54 m.). Tip chord 4 ft. 5 in. (1.35 m.). Dihedral 4° 30′. Aileron area 47.4 sq. ft. (4.4 m.²). Total flap area 156 sq. ft. (14.43 m.²). Gross wing area 963 sq. ft. (89.3 m.²).



The Vickers Viscount 700 Series Airliner.

FUSELAGE.—All-metal stressed-skin structure. The entire fuselage except nose-wheel retraction bay and extreme rear is pressurized to 6½ lb./sq. in. (0.45 kg./cm.²).

TAIL UNIT.—Cantilever monoplane structure. Single fin and rudder and 15° dihedral on tailplane. All-metal construction. Spring tabs in all control surfaces. Thermal de-icing. Total tailplane area 203 sq. ft. (18.8 m.²). Elevator area (including tabs) 104 sq. ft. (9.67 m.²). Fin area 62 sq. ft. (5.75 m.²). Rudder area 62 sq. ft. (5.75 m.²).

LANDING GEAR.—Retractable tricycle type, hydraulically-operated. All units have single Vickers shock-absorbers supporting twin wheels. Dunlop or Goodyear wheels and brakes. Wheel track 23 ft. 10 in. (7.27 m.); wheel base 24 ft. 10.6 in. (7.58 m.).

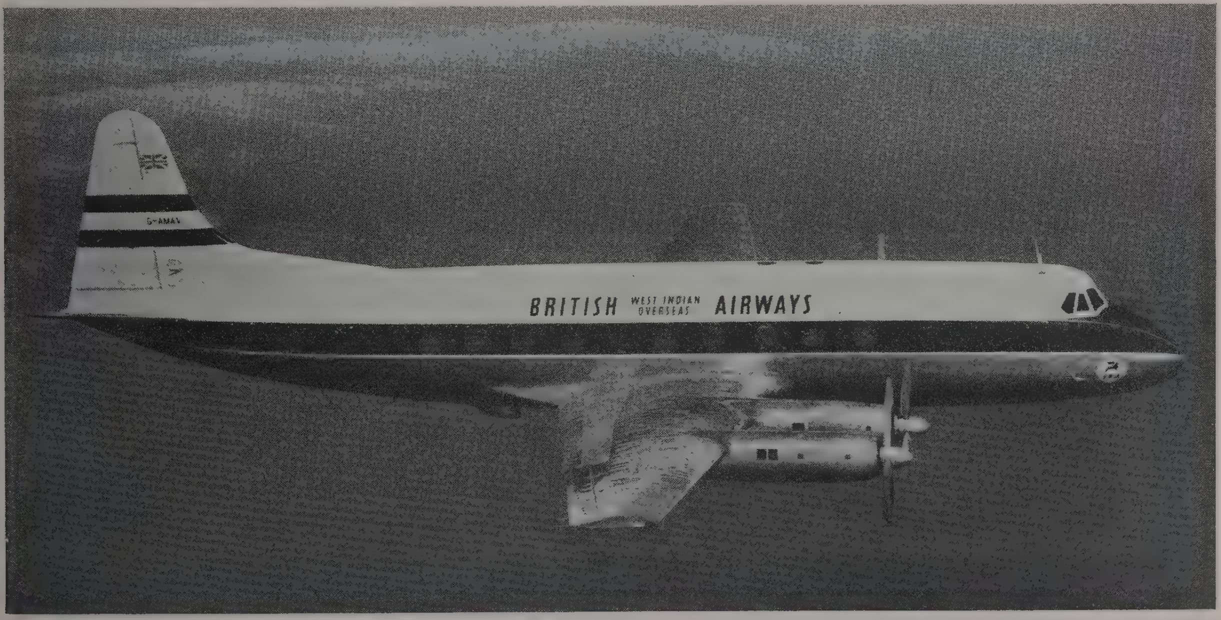
POWER PLANT.—Four 1,400 s.h.p. Rolls-Royce Dart 506 (700 Series) or 1,600 s.h.p. Dart 510 (700D Series) turboprop engines, each driving a four-blade Rotol fully-feathering 10 ft. (3.05 m.) diameter airscrew. Total internal fuel capacity 1,720 Imp. gallons (7,810 litres) in bag-type tanks forward and aft of main wing spar. Water methanol system for boosted take-off; total capacity 75 Imp. gallons (340 litres).

ACCOMMODATION.—Normal accommodation for 40 passengers, but up to 59 can be seated in high-density version. Normal crew of three or four, comprising two pilots and one or two stewards. Separate crew station for radio-operator/navigator optional; when not carried, radio and radar are operated by remote control from second pilot's seat. Pantry forward of main cabin, toilet compartment at the rear. Three large freight and luggage compartments, one forward of main cabin, capacity 110 cub. ft. (3.11 m.³) one aft with separate door on starboard side, capacity 204 cub. ft. (5.77 m.³) one below floor level forward, with two access doors, capacity 215 cub. ft. (6.08 m.³). Continuous main passenger cabin with seats each side of central gangway. Cabin height 6 ft. 5 in. (1.96 m.). Maximum width at arm-rest level is 9 ft. 5 in. (2.88 m.). Combined pressurization, air-conditioning and temperature control, giving ground-level conditions up to 15,000 ft. (4,575 m.) and 8,000 ft. (2,440 m.) conditions at 30,000 ft. (9,150 m.). Provision for external air conditioning when on ground.

DIMENSIONS.—
Span 93 ft. 8½ in. (28.5 m.).
Length 81 ft. 2 in. (24.4 m.).
Height 26 ft. 9 in. (8.05 m.).

WEIGHTS (700 Series—3-crew 40-passenger layout).—

Weight empty (equipped—includes crew, oil, etc.) 35,500 lb. (16,120 kg.),



The Vickers Viscount (four Rolls-Royce Dart turboprop engines) in the colours of British West Indian Airways.

Max. payload and catering allowance 12,700 lb. (5,760 kg.).
Max. "Zero Fuel" weight 48,000 lb. (21,750 kg.).
Max. all-up weight 58,500 lb. (26,560 kg.).
Max. landing weight 52,000 lb. (23,608 kg.).

WEIGHTS (700D—2-crew, 40-passenger layout).—
Weight empty (equipped—includes crew, oil, etc.) 36,776 lb. (16,700 kg.).
Max. payload and catering allowance 12,250 lb. (5,550 kg.).
Max. "Zero Fuel" weight 49,000 lb. (22,250 kg.).
Max. all-up weight 60,000 lb. (27,240 kg.).
Max. landing weight 54,000 lb. (24,520 kg.).

PERFORMANCE (700 Series—3-crew 40-passenger layout).
Cruising speed on max. continuous power at 53,000 lb. (24,000 kg.) at 25,000 ft. (7,625 m.) under I.C.A.N. conditions 323 m.p.h. (517 km.h.).
Cruising speed on recommended power at 53,000 lb. (24,000 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 324 m.p.h. (518 km.h.).
Rate of climb on max. continuous power at 58,500 lb. (26,560 kg.), I.C.A.N. conditions flaps up, on four engines, 1,200 ft./min. (366 m./min.) at sea level and 700 ft./min. (202 m./min.) at 15,000 ft. (4,575 m.).
Rate of climb on take-off power at 58,500 lb. (26,560 kg.), I.C.A.N. conditions, 20° flap and under-carriage up, take-off power and one engine inoperative 732 ft./min. (223 m./min.) at sea level, and 540 ft./min. (165 m./min.) at 6,000 ft. (1,830 m.).
Ceiling (based on rate of climb of 200 ft./min. = 61 m./min.) I.C.A.N. conditions at 52,000 lb. (23,608 kg.) on max. continuous power 28,500 ft. (8,680 m.).
Take-off distance to 50 ft. (15.2 m.) at 58,500 lb. (26,560 kg.), I.C.A.N. sea level conditions, four engines, 1,430 yds. (1,307 m.).
Take-off distance to 50 ft. (15.2 m.) at 58,500 lb. (26,560 kg.), I.C.A.N. sea level conditions, with one engine failure at critical point, 1,680 yds. (1,536 m.).
Landing distance from 50 ft. (15.2 m.) at 52,000 lb. (23,608 kg.), I.C.A.N. conditions, 950 yds. (870 m.).
Range and payload depend on operational requirement and fuel reserves.

PERFORMANCE (700D—2-crew, 40 passenger layout).
Cruising speed on max. continuous power at 54,000 lb. (24,500 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 334 m.p.h. (534 km.h.).
Cruising speed on recommended power at 54,000 lb. (24,500 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 324 m.p.h. (518 km.h.).
Rate of climb on max. continuous power at 60,000 lb. (27,215 kg.) I.C.A.N. conditions, flaps up, on four engines 1,400 ft./min. (426 m./min.) at sea level and 700 ft./min. (213 m./min.) at 15,000 ft. (4,575 m.).
Rate of climb on take-off power at 60,000 lbs. (27,215 kg.) I.C.A.N. conditions, 20° flap, undercarriage up and one engine inoperative 750 ft./min. (229 m./min.) at sea level and 520 ft./min. (159 m./min.) at 6,000 ft. (1,829 m.).
Ceiling based on a rate of climb of 200 ft./min. = 61 m./min.) I.C.A.N. conditions at 54,000 lb. (24,500 kg.) on max. continuous power 27,500 ft. (8,320 m.).
Take-off distance to 50 ft. (15.2 m.) at 60,000 lb. (27,215 kg.) I.C.A.N. sea level conditions, four engines, 1,320 yds. (1,210 m.).
Take-off distance to 50 ft. (15.2 m.) at 60,000 lb. (27,300 kg.) I.C.A.N. sea level conditions with one engine inoperative at critical point 1,550 yds. (1,416 m.).
Landing distance from 50 ft. (15.2 m.) at 54,000 lb. (24,500 kg.) I.C.A.N. sea level conditions 1,023 yds. (936 m.).
Range and payload depend on operational requirements and fuel reserves.

THE VICKERS VISCOUNT 800 SERIES.

The Viscount 800 Series airliner is a "stretched" version of the 700, which is particularly suitable for high-density short-haul routes. It is not intended as a replacement of the 700 Series but as a complementary aircraft.

The fuselage of the 800 Series will be wider and 46 inches (1.17 m.) longer than that of the 700, while the rear pressure bulkhead will be moved aft by 65 inches (1.65 m.), giving a total extra cabin length of 111 inches (2.82 m.). This will enable the aircraft to carry from 44 to 70 passengers as compared with the 40-59 seats of the 700 Series.

The seating arrangements in the 800 Series can be very flexible. Seventy passengers can be accommodated in twelve rows of five seats, two rows of four and one row of two. In a four-abreast arrangement there can be fourteen rows plus two extra seats (58 total) or, in an extra spacious layout, eleven rows of four (44 total).

One of the features of the 800 Series is that the pantry and forward bulkhead will be mounted on rails so that the capacity of the cabin compartment can be adjusted between freight and passengers. When necessary the seats can be folded out of the way to make room for freight. The floor of the forward part of the cabin will be strengthened to take concentrated freight loads. To facilitate the loading of freight, the forward entrance door is rectangular and specially large.

Except for the fuselage all other features, including wings and power-plant, will be the same as for the 700D.

Type 802. Four 1,600 s.h.p. Rolls-Royce Dart RDa.6 (Type 510) engines. Twenty-two ordered by B.E.A. To be of 53-seat configuration with maximum sector distance with full load of 950 miles (1,520 km.). For shorter high-peak routes accommodation can be for either 65 or 70 passengers. Maximum payload in passengers and freight in this B.E.A. configuration is 13,350 lb. (6,060 kg.) for a range of 650 miles (1,040 km.) with full reserves. The first 802 is due to be delivered in June, 1956.

Type 803. Nine for K.L.M. Royal Dutch Airlines. Will have payload of 12,000 lb. (5,450 kg.) and a range with maximum payload of 600 miles (960 km.). Will accommodate 53 passengers, 16 first-class and 37 tourist class. Deliveries begin in mid-1957.

Type 804. Two for Transair, Ltd., British independent operator.

DIMENSIONS.—
Same as 700 Series except:
Length 85 ft. (25.92 m.).

WEIGHTS (3-crew 53-seat layout).—
Weight empty (equipped—includes crew, oil, etc.) 38,950 lb. (17,660 kg.).
Max. payload and catering allowance 14,100 lb. (6,400 kg.).
Max. "Zero-Fuel" weight 53,000 lb. (24,060 kg.).
Max. take-off weight 62,000 lb. (28,120 kg.).
Max. landing weight 57,000 lb. (25,855 kg.).

PERFORMANCE.—
Cruising speed on max. continuous power at 55,000 lb. (24,950 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 325 m.p.h. (519 km.h.).
Cruising speed on recommended power at 55,000 lb. (24,950 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 314 m.p.h. (503 km.h.).
Rate of climb on max. continuous power at 62,000 lb. (28,120 kg.) I.C.A.N. conditions, flaps up, four engines, 1,220 ft./min. (372 m./min.) at sea level and 540 ft./min. (165 m./min.) at 15,000 ft. (4,575 m.).
Rate of climb on take-off power at 62,000 lb. (28,120 kg.), I.C.A.N. conditions, 20° flap, undercarriage up and one engine inoperative 680 ft./min. (207 m./min.) at sea level and 460 ft./min. (140 m./min.) at 6,000 ft. (1,829 m.)
Ceiling (based on a rate of climb of 200 ft./min. = 61 m./min.) I.C.A.N. conditions at 55,000 lb. (24,950 kg.) on max. continuous power 27,000 ft. (8,230 m.).
Take-off distance to 50 ft. (15.2 m.) at 62,000 lb. (28,120 kg.) I.C.A.N. sea level conditions, four engines, 1,470 yds. (1,345 m.).

The Vickers Viscount Airliner (four Rolls-Royce Dart turboprop engines) as supplied to Trans-Canadian Air Lines.

Landing distance from 50 ft. (15.2 m.) at 57,000 lb. (25,855 kg.) I.C.A.N. sea level conditions 1,120 yds. (1,024 m.).
Range and Payload depend on operational requirements and fuel allowances, but max. still air range with slipper tanks and max. payload will be 1,035 miles (1,756 km.).
Take-off distance to 50 ft. (15.2 m.) at 62,000 lb. (28,120 kg.) I.C.A.N. sea level with one engine inoperative at critical point 1,720 yds. (1,578 m.).

WESTLAND

WESTLAND AIRCRAFT, LTD.

Head Office, Works and Aerodrome: Yeovil, Somerset.

London Office: 8, The Sanctuary, Westminster, S.W.1.

Directors: Eric Mensforth, C.B.E., M.A., M.I.Mech.E., M.I.P.E. (Chairman); Lord Aberconway (Deputy Chairman); Edward C. Wheeldon, M.I.P.E. (Managing Director); D. L. Hollis Williams, B.Sc., F.R.Ae.S. (Technical Director); D. C. Collins, M.I.Mech.E., M.I.P.E. (Works Director); Sir George E. Bailey, C.B.E.; Sir Stanley W. Rawson; Sir Norman J. Hulbert, D.L., J.P.

Chief Engineer: O. L. L. Fitzwilliams, B.A. (Eng.), A.F.R.Ae.S.

Chief Designer: P. E. Q. Shunker, B.Sc., A.F.R.Ae.S., M.I.Ae.S.

Secretary: C. T. Jones, A.S.A.A.

Westland Aircraft, Ltd. was formed in July, 1935, to take over the aircraft branch of Petters, Ltd., previously known as the Westland Aircraft Works, which had been engaged in aircraft design and construction since 1915.

Since the war Westland has developed the Wyvern Naval Strike aircraft which is now in production in its Mk. 4 version, and has been engaged in helicopter development. The Westland Dragonfly was the first helicopter of British manufacture to receive a Certificate of Airworthiness and is being produced in both military and civil versions. More recently Westland has acquired the licence to build the Sikorsky S-55 helicopter, which is now in production as the Whirlwind.

A subsidiary company, Normalair, Ltd., specialises in the design and manufacture of aircraft cabin atmosphere control systems, associated oxygen equipment and high-altitude breathing apparatus. Able to supply complete aircraft installations, Normalair, Ltd. are recognised as the foremost European authority in this field. All British pressurised aircraft, both civil and military, use Normalair equipment, as do many aircraft of foreign design. Among the many aircraft using Normalair equipment are the Vickers Viscount, Bristol Britannia, English Electric Canberra, Hawker Hunter, Vickers Valiant, Avro Vulcan, Handley Page Victor, Gloster Javelin, Avro (Canada) CF.100 and Marcel Dassault Mystère.

THE WESTLAND WYVERN.

The Wyvern Single-seat Strike Fighter was designed to the requirements of the Royal Navy and is now in production in its latest Mk. 4 form. The stages of development of the Wyvern are as follow:

Wyvern T.F. Mk. 1. One 3,500 h.p. Rolls-Royce Eagle 24-cylinder flat H sleeve-valve engine driving a Rotol eight-blade co-axial contra-rotating airscrew. First flew on December 12, 1946.

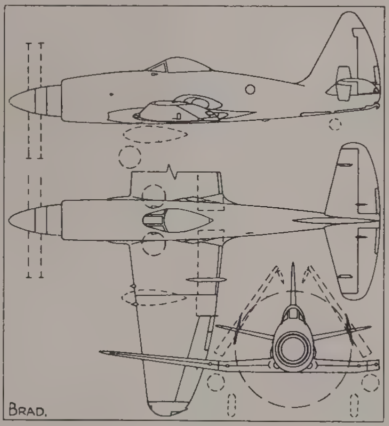
Wyvern T.F. Mk. 2. One Armstrong Siddeley Python turboprop engine developing 3,670 s.h.p. and 1,150 lb. (520 kg.) s.t. Rotol eight-blade co-axial contra-rotating airscrew. First T.F. Mk. 2 flew on March 22, 1949, and first carrier trials began in H.M.S. *Illustrious* on June 21, 1950.

Wyvern T. Mk. 3. A two-seat dual-control version of T.F. Mk. 2. Tandem cockpits with instructor in rear seat. First flew in February 11, 1950.

Wyvern S. Mk. 4. Present production version, to which the description below refers.

Type.—Single-seat Naval Strike Aircraft.

Wings.—Low-wing cantilever monoplane. Wing section 65-2-212 to 14 modified at leading and trailing edges. Aspect ratio 5.5. Chord 10 ft. 6 in. (3.20 m.) at root, 8.15 ft. (2.48 m.) mean. Dihedral —1° inner wing, +6° outer wing. All-metal flush-riveted and spot-welded stressed-skin aluminium-alloy structure. Centre-section built integral with fuselage. Outer wings fold upward hydraulically. Westland-Irving ailerons of sealed forward-balance type with spring tabs and electrically-controlled trimmer-tab. Hydraulically-operated Youngman lift flaps and air brake flaps on inner wing; brake and landing flaps on outer wing sections. Total area of ailerons 32.44 sq. ft. (3.01 m.²). Total area of lift flaps 59 sq. ft. (5.48 m.²), of air brake flaps 25 sq. ft. (2.32 m.²). Gross wing area 355 sq. ft. (32.97 m.²).



The Westland Wyvern S. Mk. 4.

Fuselage.—All-metal flush rivetted stressed-skin aluminium-alloy structure aft of engine mounting attachment bulkhead. Rear section detachable at a transport joint at approximately 9 ft. 7 in. (2.93 m.) aft of wing main spar.

Tail Unit.—Cantilever monoplane type. All-metal flush rivetted stressed-skin aluminium-alloy structure of generally similar construction to wings. Fin detachable at base. Tailplane has 10° dihedral and is separately attached to the fuselage at base of fin. Elevators have sealed-type forward balance with small tiphorn balances; spring-tab on port elevator, mechanically-operated trim-tab on starboard. Rudder has sealed forward balance with small inset horn, and electrically-controlled trim-tab. Areas: fin (including stub fins) 47.6 sq. ft. (4.42 m.²), rudder 13.3 sq. ft. (1.23 m.²), tailplane 67.8 sq. ft. (6.29 m.²), elevators 30.7 sq. ft. (2.85 m.²). Span of tail 20 ft. (6.10 m.).

Landing Gear.—Fully-retractable tail-wheel type. Hydraulic retraction. Dowty liquid-spring shock-absorbers. Dunlop wheels and pneumatic bag-type brakes. Sting-type arrester hook flush in fuselage under-surface abaft tail-wheel. Track 14 ft. 5 in. (4.39 m.).

Power Plant.—One Armstrong-Siddeley Python 3 axial-flow turboprop engine with a take-off rating of 3,670 s.h.p. plus 1,180 lb. (536 kg.) jet thrust. Rotol eight-bladed contra-rotating airscrew. Six fuel tanks, two in outer wing leading-edges (95 Imp. gallons = 432 litres each), two in inner wing (29 Imp. gallons = 132 litres each), one in front fuselage (90 Imp. gallons = 410 litres), and one in rear fuselage (173 Imp. gallons = 787 litres). Total internal fuel capacity 511 Imp. gallons (2,325 litres). Provision for two external drop tanks (90 Imp. gallons = 410 litres each) under outboard ends of inner wing.

Accommodation.—Pilot's cockpit above the wing centre-section to give an extensive view for deck landing and all Naval operations. The windscreen has flat sides and curved central panel. Jettisonable hood and a cartridge-operated ejector seat.

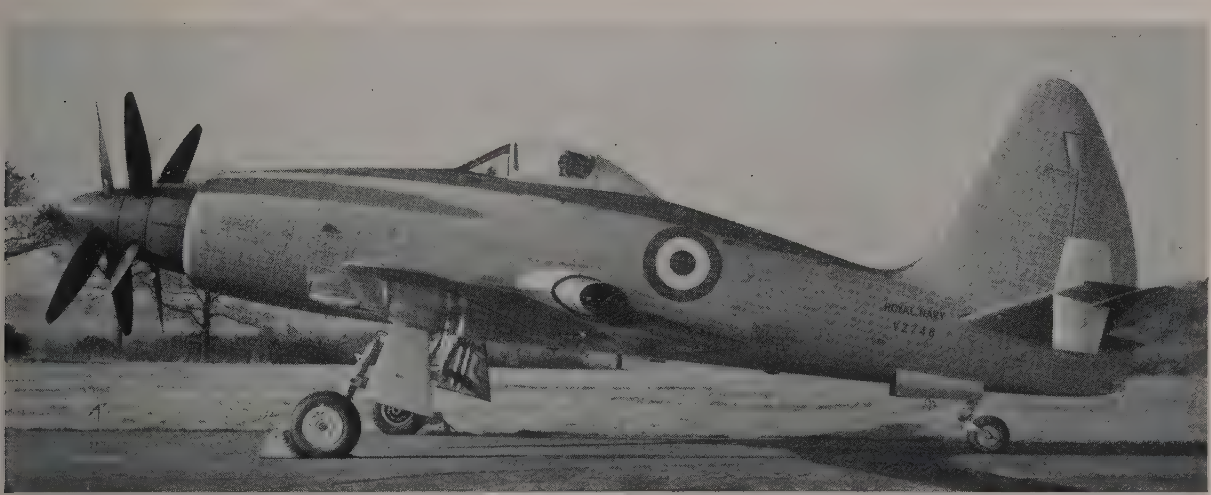
Armament.—Four 20 mm. cannon, two in each wing, one inboard and one outboard of wing fold. External stores may include torpedo, bombs, mines or depth charges beneath fuselage, rockets under wings, etc.

Dimensions.—
Span 44 ft. (13.42 m.).
Length 42 ft. (12.88 m.).
Height (wings spread) 15 ft. (4.57 m.).
Height (wings folded) 16 ft. 9 in. (5.11 m.).
Max. width (wings folded) 20 ft. (6.10 m.).

Weights and Performance.—
No data available.

THE WESTLAND DRAGONFLY.

Westland acquired the licence to build the Sikorsky S-51 helicopter in 1947. Since then the Westland-built S-51, or Dragonfly, has been supplied to many commercial organisations in England and abroad.



The Westland Wyvern S. Mk. 4 Naval Strike Monoplane (Armstrong Siddeley Python turboprop engine).

The Westland Dragonfly H.R. Mk. I Naval Helicopter (550 h.p. Alvis Leonides 50 engine).

Westland has also developed a special military version with modified cabin, large radio bay and other additions to meet the requirements of the R.A.F. and Royal Navy. The military Dragonfly has been produced in the following versions, all of which are in service.

Dragonfly H.R.Mk. 1. Alvis Leonides 50 engine. Fully-equipped for Sea Rescue and special photography. Supplied to the Royal Navy.

Dragonfly H.C. Mk. 2. Alvis Leonides 50 engine. Primarily equipped for casualty evacuation. Two stretcher cases may be carried in enclosed panniers, one on each side of fuselage, with alternative cabin accommodation for sitting casualties. Supplied to the Royal Air Force.

Dragonfly H.R. Mk. 3. Alvis Leonides 50 engine. All-metal main rotor blades and hydraulic servo control mechanism. In service with Royal Navy.

Dragonfly H.C. Mk. 4. Alvis Leonides 50 engine. Improved H.C. Mk. 2 with all-metal main rotor blades and hydraulic servo control mechanism. In service with the Royal Air Force.

Two civil versions of the Dragonfly are available :—

Mk. IA. Alvis 521/1 engine. Equipped passenger transport or several other rôles.

Mk. IB. Pratt & Whitney R-985 engine. Otherwise same as Mk. IA.

The description which follows applies primarily to the civil Dragonfly Mk. IA powered by the Alvis Leonides Mk. 521/1 engine, but is typical of all civil and military versions.

Type.—Four-seat Single-rotor Helicopter.

Rotors.—Three-blade main rotor and three-blade anti-torque tail rotor. Free-flapping blades with hinges on centre-line of rotor. Hydraulic servo control mechanism. Main rotor blades of all-metal construction. Main rotor blade area 30.8 sq. ft. (2.86 m.^{2}) each. Disc area of main rotor 1,885 sq. ft. (175.21 m.^{2}), of tail rotor 55.6 sq. ft. (5.16 m.^{2}). Main rotor drive by shaft through double epicyclic reduction gear. Main rotor/engine r.p.m. ratio 1 : 11.88. Anti-torque rotor/engine r.p.m. ratio 1 : 1.80.

Fuselage.—Semi-monocoque light alloy cabin and tail cone, tubular steel centre section.

Landing Gear.—Three-wheel type with swivelling nose wheel. Turner oleo-pneumatic shock-absorber legs. Dunlop wheels. Track : 12 ft. (3.66 m.). Wheelbase : 10 ft. 1 in. (3.08 m.).

Power Plant.—One 500/520 h.p. Alvis Leonides 521/1 radial engine mounted horizontally in fuselage centre-section and driving main rotor through vertical shaft and double epicyclic reduction gearing. Two 41.5 Imp. gallon (188 litre) fuel tanks in fuselage centre section.

Accommodation.—Enclosed cabin seating four, pilot in front and three passengers abreast at rear of cabin. Dual control with pilot and co-pilot in tandem possible. Cabin easily adapted to freight carrying. Sliding doors on each side.

Dimensions.—
- Main rotor diameter (Dragonfly Mk. 1 and 2) 48 ft. (14.64 m.).
- Main rotor diameter (Dragonfly Mk. 3 and 4) 49 ft. (14.94 m.).
- Overall length 57 ft. 6½ in. (17.54 m.).
- Length of fuselage 41 ft. 1¾ in. (12.53 m.).
- Overall width 41 ft. 9 in. (12.73 m.).
- Height to top of rotor pylon 12 ft. 11⅜ in. (3.93 m.).
- Diameter of anti-torque rotor 8 ft. 5 in. (2.56 m.).

Weights (Civil Mk. IA).—
- Weight empty 4,366 lb. (1,980 kg.).
- Useful load 530 lb. (240 kg.).
- Disposable load 1,334 lb. (606 kg.).
- Normal loaded weight 5,700 lb. (2,587 kg.).
- Max. loaded weight 5,870 lb. (2,660 kg.).

Weights (Dragonfly Mk. 1).—
- Weight empty 4,380 lb. (1,988 kg.).
- Disposable load 1,490 lb. (676 kg.).
- Normal loaded weight 5,870 lb. (2,665 kg.).

Weights (Dragonfly Mk. 2).—
- Weight empty (including panniers) 4,450 lb. (2,020 kg.).
- Disposable load 1,420 lb. (645 kg.).
- Weight loaded 5,870 lb. (2,665 kg.).

Weights (Dragonfly Mk. 4).—
- Weight empty (including panniers) 4,520 lb. (2,052 kg.).
- Disposable load 1,350 lb. (613 kg.).
- Weight loaded 5,870 lb. (2,665 kg.).

Performance (Civil Mk. IA).—
- Max. speed at S/L. 103 m.p.h. (164.8 km.h.).
- Cruising speed 85 m.p.h. (136 km.h.).
- Hovering ceiling (without ground effect) 6,000 ft. (1,830 m.).
- Hovering ceiling (with ground effect) 8,000 ft. (2,440 m.).
- Service ceiling 11,000 ft. (3,360 m.).
- Still air range 300 miles (480 km.) with fuel reserve for 20 min. further flight.

Performance (Dragonfly Mk. 1).—
- Max. speed at S/L. 95 m.p.h. (152 km.h.).
- Cruising speed 85 m.p.h. (136 km.h.).
- Hovering ceiling (without ground effect) 4,600 ft. (1,403 m.).
- Hovering ceiling (with ground effect) 5,600 ft. (1,708 m.).
- Best rate of climb at S/L. 800 ft./min. (244 m./min.).
- Vertical rate of climb at S/L. 50 ft./min. (15.25 m./min.).
- Service ceiling 12,400 ft. (3,780 m.).
- Still air range 300 miles (480 km.).

Performance (Dragonfly Mk. 2 with panniers).—
- Max. speed at S/L. 88 m.p.h. (141 km.h.).
- Cruising speed 78 m.p.h. (125 km.h.).
- Still air range 275 miles (440 km.).
- Other figures as for Mk. 1.

Performance (Dragonfly Mk. 3).—
- Max. speed at S/L. 95 m.p.h. (152 km.h.).
- Cruising speed 85 m.p.h. (136 km.h.).
- Hovering ceiling (without ground effect) 6,000 ft. (1,830 m.).
- Hovering ceiling (with ground effect) 7,000 ft. (2,135 m.).
- Best rate of climb at S/L. 1,000 ft./min. (305 m./min.).
- Vertical rate of climb at S/L. 260 ft./min. (79 m./min.).
- Service ceiling 13,200 ft. (4,030 m.).
- Still air range 300 miles (480 km.).

Performance (Dragonfly Mk. 4 with panniers).—
- Max. speed at S/L. 88 m.p.h. (141 km.h.).
- Cruising speed 78 m.p.h. (125 km.h.).
- Still air range 275 miles (440 km.).
- Other figures as for Mk. 3.

THE WESTLAND WIDGEON.

The Widgeon is a developed version of the Dragonfly which has an entirely new forward fuselage to seat five. The power-plant is the same as for the Dragonfly but a re-designed rotor-head incorporating offset flapping hinges gives a greater C.G. range and eliminates ballasting for differing loading arrangements.

The Westland Dragonfly H.C. Mk. 2 Casualty Evacuation Helicopter (550 h.p. Alvis Leonides 24 engine).

The Westland Sikorsky Whirlwind H.A.R. Mk. I Naval Helicopter (600 h.p. Pratt & Whitney R-1340 engine).

The Widgeon will be available in three versions: as a passenger carrier with accommodation for pilot and four passengers; as an ambulance to carry pilot, two stretcher cases entirely within the cabin and medical attendant; and as a rescue aircraft with a pilot-operated winch.

The Widgeon prototype made its first flight on August 23, 1955.

Weights.—
- Weight empty 4,424 lb. (2,030 kg.).
- Weight loaded 5,900 lb. (2,680 kg.).

Performance.—
- Max. speed at S/L. 95 m.p.h. (152 km.h.).
- Cruising speed 80 m.p.h. (128 km.h.).
- Rate of climb at S/L. 970 ft./min. (296 m./min.).
- Service ceiling 10,500 ft. (4,200 m.).
- Hovering ceiling 7,500 ft. (2,290 m.).
- Max. range 300 miles (480 km.).

THE WESTLAND WHIRLWIND.

The Whirlwind exists in five military versions. These are :—

Whirlwind H.A.R. Mk. 1. 600 h.p. Pratt & Whitney R-1340-40 engine. For Royal Navy.

Whirlwind H.A.R. Mk. 2. 600 h.p. Pratt & Whitney R-1340-40 engine. For Royal Air Force.

Whirlwind H.A.R. Mk. 3. 700 h.p. Wright R-1300-3 engine. For Royal Navy.

Whirlwind H.A.R. Mk. 4. 600 h.p. Pratt & Whitney R-1340-57 engine. For Royal Air Force.

Whirlwind H.A.R. Mk. 5. 700 h.p. Alvis Leonides Major engine. For Royal Navy.

A number of Sikorsky-built S-55 helicopters have been supplied to the Royal Navy under M.D.A.P. and these have now been given designations in the "Whirlwind" series as follows :—

Whirlwind H.A.R. Mk. 21. Sikorsky-built HRS-2 transport helicopter in service in the Royal Navy. 550 h.p. Pratt & Whitney R-1340 engine.

Whirlwind H.A.S. Mk. 22. Sikorsky-built H04S-3 anti-submarine and rescue helicopter in service with the Royal Navy. 700 h.p. Wright R-1300 engine.

The Westland Whirlwind in its civil form, powered by the Pratt & Whitney R-1340 engine, has been supplied to British European Airways for passenger transport and to other European commercial organisations.

The following specification applies to the military Mks. 1 and 2 and to the civil Whirlwind :—

Type.—Military or Civil Helicopter.

Rotor.—Three-blade main rotor, two-blade anti-torque tail rotor. Main rotor blades on offset flapping hinges with hydraulic damping about drag hinges. Swash-plate control mechanism. All-metal blades have extruded spars and light alloy skinned trailing-edges. Main rotor blade area 32.5 sq. ft. (3.02 m.^{2}) each. Disc area of main rotor 2,206 sq. ft. (204.93 m.^{2}). Disc area of tail rotor 61 sq. ft. (5.66 m.^{2}). Main rotor drive by inclined shaft through helical bevel gears and double epicyclic reduction. Main rotor/engine r.p.m. ratio 11.3 : 1. Anti-torque rotor/engine r.p.m. ratio 1.62 : 1.

Fuselage.—Rectangular light alloy semi-monocoque structure with metal cone extension carrying tail rotor.

Landing Gear.—Four-wheel type, with forward pair of wheels castoring and rear pair taking main landing and brake loads. Turner air-oil shock struts. Dunlop wheels and brakes. Track 11 ft. (3.35 m.) main wheels, 4 ft. 6 in. (1.37 m.) nose wheels. Wheelbase 10 ft. 4 in. (3.15 m.).

Power Plant.—One 600 h.p. Pratt & Whitney R-1340-40 Wasp radial air-cooled engine on inclined axis in nose compartment and driving main rotor gear-box by sloping shaft. Nose doors give access to engine installation. Fuel tanks (145 Imp. gallons=657 litres) under cabin floor.

Accommodation.—Cockpit seating two side-by-side with dual controls in nose above

A Westland Whirlwind Helicopter equipped with flotation gear, etc. for British European Airways.

engine. Main cabin 6 ft. × 10 ft. × 5 ft. 6 in. (1.82 m. × 3.05 m. × 1.67 m.) directly under rotor head can accommodate wide variety of loads, including 10 fully-armed troops, six stretchers, etc. Loading door 4 ft. × 4 ft. (1.22 m. × 1.22 m.) on starboard side. Power operated pilot-controlled hydraulic hoist for lifting loads while hovering. Cargo capacity 340 cub. ft. (9.6 $m.^3$).

DIMENSIONS.—
- Main rotor diameter 53 ft. (16.1 m.).
- Overall length 62 ft. 1½ in. (18.95 m.).
- Length of fuselage 41 ft. 8½ in. (12.71 m.).
- Overall width 45 ft. 9½ in. (13.94 m.).
- Height to top of rotor pylon 13 ft. 3 in. (4.04 m.).
- Diameter of ante-torque rotor 8 ft. 11 in. (2.74 m.).

WEIGHTS (Civil Whirlwind).—
- Weight empty 5,010 lb. (2,280 kg.).
- Disposable load 2,490 lb. (1,130 kg.).
- Weight loaded 7,500 lb. (3,420 kg.).

WEIGHTS.—
- Weight empty 5,286 lb. (2,400 kg.).
- Disposable load 2,214 lb. (1,105 kg.).
- Normal loaded weight 7,500 lb. (3,405 kg.).

PERFORMANCE.—
- Max. speed at S/L. 112 m.p.h. (179 km.h.).
- Cruising speed 86 m.p.h. (138 km.h.).
- Hovering ceiling (without ground effect) 3,200 ft. (976 m.).
- Best rate of climb at S/L. 860 ft./min. (262 m./min.).
- Service ceiling 7,000 ft. (2,130 m.).
- Still air range 300 miles (480 km.).

THE WESTLAND WESTMINSTER.

The name Westminster has been given to a new helicopter which is being developed by Westland. Designed to meet a variety of military rôles, the Westminster will be powered by two gas-turbine engines and will be capable of carrying 40 passengers or 32 stretcher cases.

The Westminster will have a single main rotor which will be driven by twin engines mounted above the cabin. It will have a maximum all-up weight of 33,000 lb. (14,890 kg.), of which 13,000 lb. (5,900 kg.) will be available as disposable load.

At the above designed all-up weight the Westminster will have a range with full fuel load of 360 miles (576 km.) at a cruising speed of 150 m.p.h. (240 km.h.).

AUSTRALIA

GOVERNMENT FACTORIES

DIVISION OF AIRCRAFT PRODUCTION, DEPARTMENT OF DEFENCE PRODUCTION.

Head Office: 8th Floor, 339 Swanston Street, Melbourne.

Director of Aircraft Production: V. F. Letcher.

Aircraft Factories: Fishermen's Bend and Essendon, Melbourne.

General Manager: M. B. Woodfull.

Maintenance Branch: Fairfield, Melbourne and Parafield, South Australia.

Manager: M. A. W. Forestier.

Engine Factory: Lidcombe, New South Wales.

Managed by the Commonwealth Aircraft Corporation Pty. Ltd.

Propeller Annexe, Alexandria, New South Wales.

Managed by the de Havilland Aircraft Pty. Ltd.

Heavy Forge Annexe.

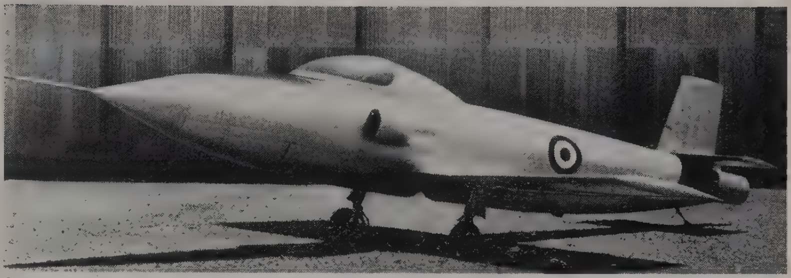
Managed by the Australian Aluminium Company Pty. Ltd.

Production of the English Electric Canberra twin-jet bomber, powered with Rolls-Royce Avon engines, followed the completion during 1953 of the last of the 73 Avro Lincoln four-engined heavy bombers at the Australian Government Aircraft Factories. The first Australian-built Canberra B. Mk. 20 made its first flight on May 29, 1953. A structural description of the Canberra will be found under "English Electric."

Early in 1948 a series of meetings was held in London between representatives of the British Ministry of Supply and the Australian Department of Supply and Development to draft a specification covering the design and manufacture of a high-speed pilotless target aircraft for use in the guided missile development programme. This was issued in March, 1948 as Ministry of Supply Specification No. E7/48 and design work on the project began shortly after at the Government Aircraft Factories in Melbourne.

In order to reduce the overall development period, it was considered desirable that a piloted version should be designed concurrently with the pilotless to provide a human check on general flight characteristics and functioning of the remote controlling equipment. At the same time it was agreed that both versions should be fitted with the Armstrong Siddeley Adder engine, a pure jet development of the Mamba turboprop engine, giving a maximum thrust of 1,050 lb. (475 kg.). The Jindivik Mk. 2 is powered by an Armstrong Siddeley "short-life" Viper turbojet engine which has a thrust rating of 1,640 lb. (745 kg.).

Before proceeding with descriptions of both types, it may be pertinent to note that the piloted variant, known as the Pika, was the first Australian-designed jet aircraft to take the air, while the pilotless version, the Jindivik, was the first remotely-controlled jet aircraft to be built in the British Commonwealth.



The Pika pilotless Target Aircraft (Armstrong Siddeley Adder turbojet engine).

THE PIKA PILOTED TEST VEHICLE.

The piloted version, the first prototype of which made its initial flight in October, 1950, was originally locally known as Project C, but is now named Pika (an aboriginal word meaning "flier"). It differs little from the pilotless aircraft, either in overall dimensions or in basic layout or planform. Nor is its all-up weight very much greater as, by reducing its fuel capacity and omitting some special items of equipment required only on target trials, the additional weight associated with the pilot has been almost counterbalanced.

There are, however, three major differences between the versions. First, of course, there is the cockpit complete with all the necessary flying and engine instruments, controls, warning lights, oxygen system, etc. The un-manned aircraft requires no such facilities. Second, the air for the engine is taken in through intakes on either side of the fuselage adjacent to the cockpit instead of through the top submerged entry used on the pilotless model.

The third big difference lies in the landing-gear. While a skid is fitted to the pilotless version, the piloted aircraft has what is possibly the smallest retractable landing-gear ever produced. The main legs, containing conventional oleo-pneumatic struts and equipped with wheels, high-pressure tyres of less than 13 in. (33 cm.) diameter and hydraulic brakes, are retracted into the wing/fuselage junctions. The pneumatic retracting system consists of a fixed-capacity high-pressure supply (2,000 lb./sq. in. = 140 kg./cm.^{2}) capable of providing at least four complete cycles of operation at one charge. The tail skid, with a small oleo-pneumatic strut, is not retractable.

By the end of 1954 the Pika had done a considerable amount of flying and its use for checking equipment and developing techniques has been of great value in the overall development programme.

THE JINDIVIK Mk. 1 PILOTLESS TARGET.

Known initially as Project B and now bearing the name Jindivik, also of aboriginal origin, several Mk. 1 pilotless aircraft have been completed and trials have proceeded satisfactorily since the initial flight in August, 1952.

While a high degree of aerodynamic cleanliness was required to achieve the necessary performance, the overriding considerations in the design of the Jindivik were cheapness and simplicity of construction and ease of assembly and maintenance. These conflicting factors have resulted in more compromises than would be normal on a piloted aircraft, but on the whole the aerodynamics have not suffered unduly.

Type.—Pilotless Target Aircraft.

Wings.—Mid-wing cantilever monoplane. Wing section NACA 64 Series with constant thickness/chord ratio of 10%. Aspect ratio 4.75. Two spars at 30% and 70% of chord, nose and intermediate pressed ribs and 14 S.W.G. skin reinforced by vee-section stringers. No chordwise skin joints and most forward spanwise joints on upper and lower surfaces at 50% of chord. Ailerons and flaps of circular-nosed type with sealed gap, their chord being 20% of wing chord. Ailerons operated by one of the auto-pilot servomotors, flaps by an electro-pneumatic system. Small air brake flaps of type used on the Vampire provided.

Fuselage.—Of light alloy, in three detachable sections. Nose section carries the accumulators and automatic pilot gyro units, and is hinged to allow access to control equipment. Centre fuselage houses at its front end the radio control and telemetry equipments in a removable crate. Then follows a large bay for any special unit required for target trials, and the main fuel tank bay which contains a light crash-proof rubber bag through which the air intake passes. Rear fuselage carries the engine. Two small fuel tanks located under engine and behind these are the servo motors for rudder and elevators.

Tail Unit.—Cantilever monoplane of all-metal construction. All surfaces of NACA 64 Series aerofoil section with maximum thickness/chord ratio of 8%. Movable surfaces of plain circular-nosed type with small unshielded horns enclosing mass balances.

Landing Gear.—Retractable central skid type. Skid on parallel linkage with oleo-pneumatic shock strut. As skid is not used in take-off it is normally held in retracted position by a copper shear pin, with all air exhausted from shock-strut. On receipt of "undercarriage down" signal from ground control station, air is released

The Jindivik Mk. I Pilotless Target (Armstrong Siddeley Adder engine).

from a high-pressure supply bottle to strut through reducing valve, up-lock pin is sheared and skid fully lowered. Interconnection between skid mechanism and flaps to prevent latter from contacting ground when they are in landing position and the skid is fully compressed. To allow use of flap for take-off, a spring-loaded strut is provided in the inter-connecting link, the flaps being manually moved to desired setting before take-off and automatically returned to flying position at a speed some 40% above the stall.

Power Plant.—One Armstrong Siddeley Adder ASa.1 turbojet engine in rear fuselage, front frame of which provides a sealing bulkhead. Engine shrouded to reduce heat radiation and cooling air flow is induced through rear fuselage by extractor fairing over the jet-exit. Air intake of NACA submerged type on top of body forward. Fuel system pressurised from engine compressor casing through reducing valve, fuel being pumped from tanks in rear fuselage to the main tank and thence to engines. Throttle operated by electric actuator and fuel shut-off valve by solenoid control. Starting system is normal except that the panel controlling the timed sequence of operations is carried on a van and plugged into a point on the aircraft when required.

Electrical System.—In both piloted and pilotless versions main power supply is from a standard 24 volt D.C. engine-driven generator feeding comparatively low capacity accumulator with voltage regulation. All main circuits protected by self-resetting thermal overload switches.

Remote-Control Equipment.—Control can be achieved from either a ground or airborne controlling station. Equipment consists briefly of a radio control receiver, units for interpreting external signals and applying them to control the aircraft, automatic pilot, and a telemetry transmitter for passing essential control information back to ground. In addition, a transponder is fitted to boost the radar response of the aircraft to increase the range over which it can be tracked. Notch aerials in fin leading-edge for radio receiver and telemetry transmitter.

Take-off Trolley.—Tubular framework with tricycle wheel configuration. Framework carries three arms on which aircraft is mounted, two under the wings and one under the front fuselage, together with a tie-rod connected at one end to a release hook on the aircraft and at the other end to brake cylinder on the trolley. When release is made, which is done automatically at a predetermined take-off speed, the arms collapse (with spring assistance) leaving the aircraft to fly off. At the same time brake cylinder applies pressure to the brakes on the rear wheels of the trolley. To keep the aircraft running straight during taxying, etc. the nose wheel is fitted with a servo steering mechanism monitored by a directional gyro.

The Jindivik Mk. I resting on its skid at the end of a landing run.

Dimensions.—
Span 19 ft. (5.79 m.).
Length overall 23 ft. 3¾ in. (7.11 m.).
Height (static on skid to top of fin) 6 ft. 3½ in. (1.92 m.).

Weights and Performance.—
No data available.

THE JINDIVIK Mk. 2 PILOTLESS TARGET.

The Jindivik Mk. 2 is powered by an Armstrong Siddeley Viper short-life turbojet. This version is similar in layout to the Mk. 1 but the aerodynamically-controlled features have been revised to permit full advantage to be taken of the greater thrust provided by the Viper engine. At the same time, the structure has been considerably simplified to a degree consistent with its rôle as a target aircraft constructed essentially from the lower grades of aluminium-alloy materials, demands on forgings, extrusions and machine fittings have been minimised while castings and fabricated sheet items are used extensively. Advantage has been taken of Araldite bonding methods for many major assemblies.

The first prototype of the Mk. 2 made its first test flight on December 11, 1953.

Wings.—Mid-wing cantilever monoplane. Wing section NACA 64 Series with constant thickness-chord ratio of 6% and cambered to C/L. of 0.1. Aspect ratio 4.75. Heavy four-spar box structure between 20% and 60% of chord from aircraft C/L. to wing-tip, which is closed by cast sealing rib. No rivets used, the whole box being bonded with a thermo-setting adhesive to form an integral fuel tank. Light skinned, paper honeycomb-filled fairing completes the leading-edge. Trailing-edge is of light-skinned, two-spar and multi-rib construction, and has along its rear edge a piano hinge to carry flap and aileron. Ailerons and flaps are of fluted and folded skin construction with continuous piano hinge bonded in position. No air brake fitted, landing flap being used in its take-off position. Ailerons operated by electric servo-motor, flaps by electro-pneumatic system.

Fuselage.—Of light alloy in four main sections, front fuselage, equipment bay canopy, centre fuselage and rear fuselage. Front fuselage carries automatic pilot, radio control and telemetry equipment on three removable trays. Canopy lifts off for access. Centre fuselage has at its front end a large bay for special equipment required for target trials and the main fuel tank bay as in Jindivik Mk. 1. Rear fuselage carries the engine and jet-pipe.

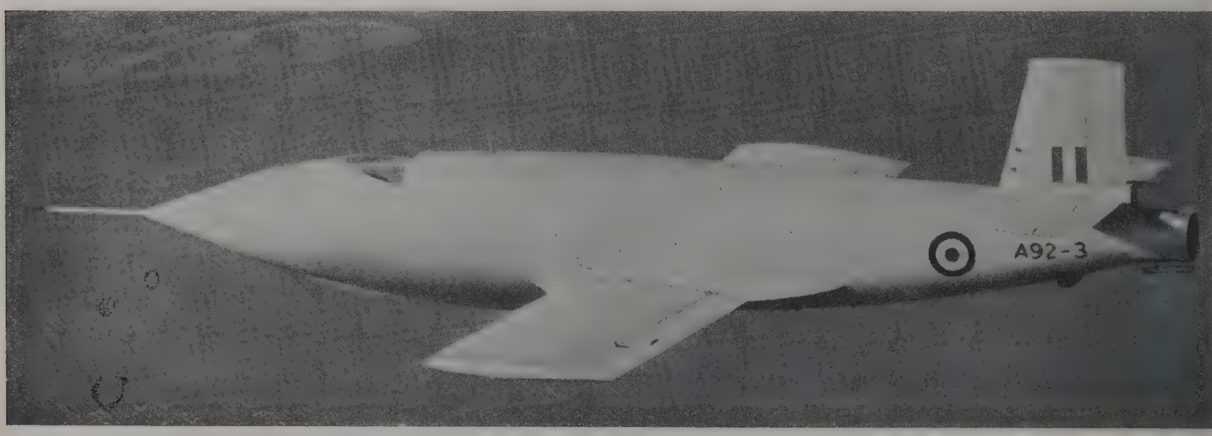
Tail Unit.—Cantilever monoplane type. Tailplane and fin are of monospar light skin honeycomb-filled construction bonded with a thermo-setting adhesive. No rudder. Elevators are piano-hinged and of fluted and folded light skin construction. Actuation by electric servo-motor mounted under tailplane.

Landing Gear.—As for Jindivik Mk. 1, but of simplified unit construction and with no linkage between rear link and flap.

Power Plant.—One Armstrong Siddeley Viper ASV.5 short-life turbojet engine (1,640 lb. = 745 kg. s.t.). One flexible fuel tank (64 Imp. gallons = 290 litres) in fuselage surrounding intake duct and two integral wing tanks (16 Imp. gallons = 73 litres each). Pressurised fuel system. Compressed air is used for engine starting, an air blast being fed into turbine blades through casing.

Electrical System, Remote-Control Equipment and Take-off Trolley.—
Same as for Jindivik Mk. 1.

Dimensions.—
Same as for Jindivik Mk. 1.



The Jindivik Mk. I Pilotless Target Aircraft in radio-controlled flight.

COMMONWEALTH

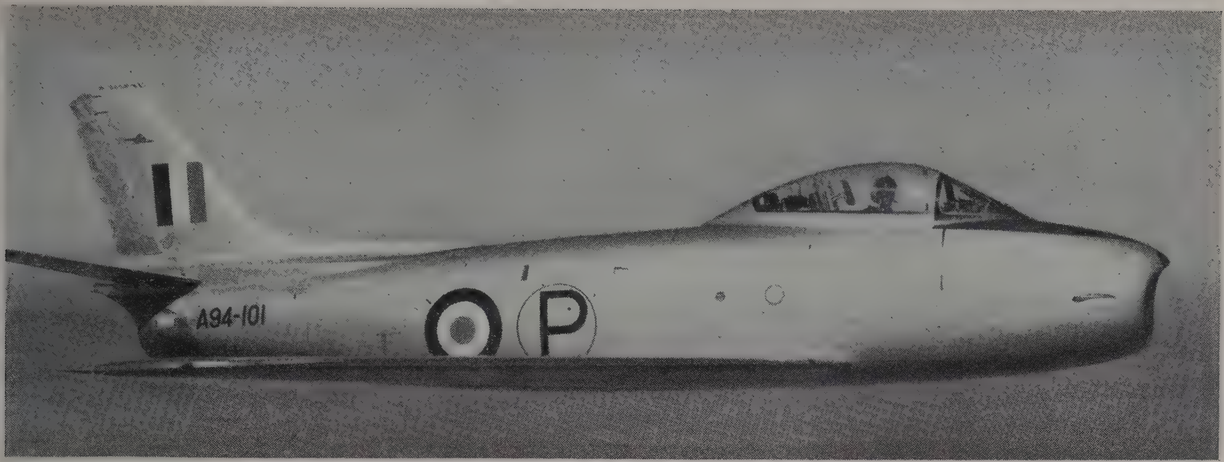
COMMONWEALTH AIRCRAFT CORPORATION PTY., LTD.

Head Office and Works: Lorimer Street, Port Melbourne, Victoria.

Directors: L. Darling (Chairman), Essington Lewis, C.H., K. G. Begg, M. L. Baillieu, J. D. Bates, Sir Alexander Stewart, Sir Lawrence Wackett, D.F.C., A.F.C., B.Sc. (Manager), A. G. Brown (Secretary).

The Commonwealth Aircraft Corporation, Pty., Ltd., was formed in 1936 under a scheme propounded by the Australian Government for the establishment of an aircraft industry to make Australia independent of outside supplies.

The Commonwealth Aircraft Corpn. has an authorised capital of £2,000,000. The shareholders include the Broken Hill Proprietary Co. Ltd.; Broken Hill Associated Smelters Pty. Ltd.; Broken Hill South Ltd.; Electrolytic Zinc Co. of Australasia, Ltd.; Imperial Chemical Industries of Australia and New Zealand, Ltd.; the Orient Steam Navigation Co. Ltd.; and Rolls-Royce Ltd.



The Commonwealth CA-27 Sabre Single-seat Fighter (Rolls-Royce Avon turbojet engine).

The latest product of the Corporation is the CA-25 three-seat basic trainer, the first prototype of which flew for the first time in February, 1955. The CA-25 has been named Winjeel (from an aboriginal word meaning Eagle).

Commonwealth are responsible for the production, under licence from North American Aviation, Inc., of the Sabre swept-wing fighter for the Royal Australian Air Force. The Australian-built Sabre has been designated the CA-27 and is powered by the Rolls-Royce Avon turbojet engine, which is also being built at the Corporation's works at Fishermen's Bend. The first flight of the prototype Avon-engined Sabre took place on August 3, 1953.

The first production Avon-Sabre of a series of ninety was handed over to the R.A.A.F. on August 30, 1954.

THE COMMONWEALTH CA-27 SABRE.

The Commonwealth Sabre, the prototype of which flew for the first time on August 3, 1953, is based on the North American F-86F and incorporates a considerable amount of local major re-design to allow it to be powered by the Rolls-Royce Avon engine of greater power and lighter installed weight. With the Avon consuming 25 per cent. more air than the J47, calling for a much larger air inlet duct; and its lighter weight, necessitating its re-positioning further aft in order to preserve the original C.G. positions; structural re-design and the re-arrangement of internal equipment has resulted in only about 40 per cent. of the original fuselage structure being retained.

A heavier cannon armament has also been installed, and provision is made for the fitting of under-wing rockets and bombs.

Type.—Single-seat Fighter.

Wings.—Low-wing cantilever monoplane with 35° sweepback. Thin laminar-flow wing section. All-metal structure of sandwich type construction in which the structural material is laminated between the inner and outer tapered skins. No ribs in inboard halves of wing panels and skin is milled from ¼″ material at roots. Fuel cells in centre-section and outboard wings. Auto slots on leading-edge. Slotted flaps. Irreversible power-operated aileron control system. Gross wing area 274 sq. ft. (25.4 m.^{2}).

Fuselage.—Oval section all-metal structure with flush-riveted stressed skin. Speed brakes near rear of fuselage.

Tail Unit.—Cantilever monoplane type. All-metal structure. All surfaces have 35° sweep-back. 10° dihedral tailplane. Tailplane and elevators controllable and linked for co-ordinated movement. Pitch control is irreversible and power-operated. Artificial sensing system to give pilot a representative feel in absence of air loads.

Landing Gear.—Retractable tricycle type with steerable nose-wheel. Hydraulic retraction. Cleveland air-oil shock struts. Extra high-pressure tyres. Bendix multiple-disc hydraulic brakes in cast magnesium main wheels. Track 8 ft. 3 in. (2.5 m.).

Power Plant.—One Rolls-Royce Avon axial-flow turbojet with straight ram air entry in nose of fuselage. Nose entry lipped above to maintain adequate air-flow in nose-up position. Main fuel tanks in fuselage. External long-range drop tanks may be carried under wings outboard of landing-gear.

Accommodation.—Pressurised pilot's cockpit with sliding bubble canopy. Pilot ejection seat.

Armament and Equipment.—No details available.

Dimensions.—
Span 37 ft. 1 in. (11.3 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 14 ft. (4.27 m.).

Weights and Performance.—No details available.

THE COMMONWEALTH CA-25 WINJEEL.

The CA-25, which first flew on February 23, 1955, is the production version of the CA-22, the prototype Winjeel, which made its maiden flight in 1950.

Type.—Three-seat Basic Trainer.

Wings.—Low-wing cantilever monoplane. Wing section NACA 23015 at root tapering to NACA 23010 at tip, with negative twist of 2½°. Aspect ratio 6. Mean chord 6 ft. 5 in. (1.96 m.). Dihedral (outer wings 5°). Two-spar aluminium-alloy structure. All-metal electrically-operated trailing-edge flaps between ailerons, including section beneath fuselage. Frise type ailerons have metal frames and fabric covering. Total flap area 35.12 sq. ft. (3.26 m.^{2}). Total aileron area 13.78 sq. ft. (1.28 m.^{2}). Gross wing area 249 sq. ft. (23.13 m.^{2}).

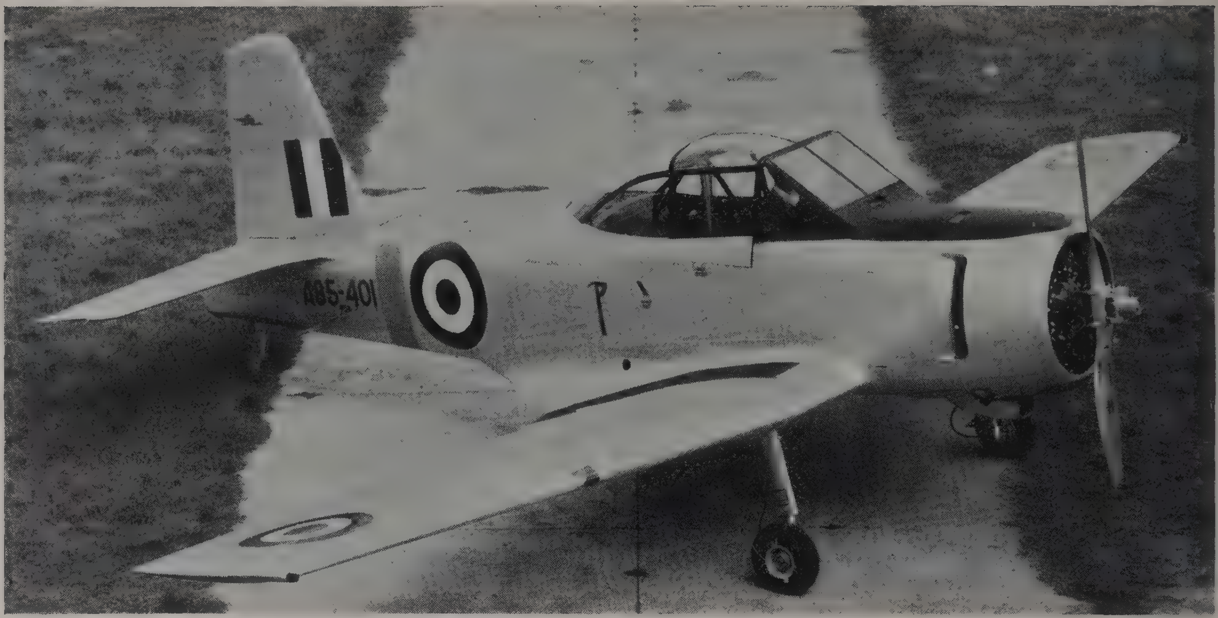
Fuselage.— Aluminium - alloy semi - monocoque structure.

Tail Unit.—Cantilever monoplane type. Metal frames with metal-covered fixed surfaces and fabric-covered rudder and elevators. Elevators have trailing-edge servo and trim tabs. Rudder has trim-tab only. Areas: fin 9.42 sq. ft. (0.88 m.^{2}), rudder 9.25 sq. ft. (0.86 m.^{2}), tailplane 49.82 sq. ft. (4.63 m.^{2}), elevators 18.84 sq. ft. (1.75 m.^{2}). Tailplane span 14 ft. (4.27 m.).

Landing Gear.—Fixed tail-wheel type. Cantilever long-stroke oleo-pneumatic shock-absorber struts. Dunlop wheels with hydraulic single-disc brakes. Free swivelling steerable tail-wheel. Track 10 ft. 1 in. (3.07 m.).

Power Plant.—One 445 h.p. Pratt & Whitney R-985-AN2 Wasp Junior nine-cylinder radial air-cooled engine on welded steel-tube mounting. Mounting attached

The Commonwealth CA-27 Sabre Single-seat Fighter (Rolls-Royce Avon turbojet engine).



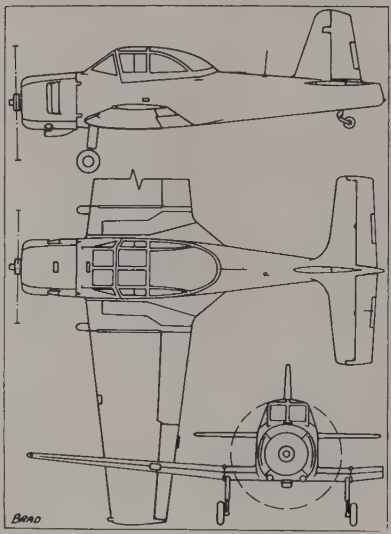
The Commonwealth CA-25 Winjeel Basic Trainer (445 h.p. Pratt & Whitney R-985 engine).

to fireproof bulkhead by four bolts and quickly removable. Cowling in four opening panels hinged at the firewall for complete engine accessibility. Hamilton Standard two-blade variable-pitch airscrew. Two flexible bag tanks (34.5 Imp. gallons = 157 litres each) between spars in centre-section. Auxiliary fuselage tank may be carried beneath centre-section (30 Imp. gallons = 136 litres).

ACCOMMODATION.—Enclosed cockpit seats three, two side-by-side with dual controls in front, plus third seat for additional pupil aft. Radio compartment beside rear seat. Sliding canopy may be jettisoned in emergency. Amber screening for blind flying training.

DIMENSIONS.—
Span 38 ft. 7½ in. (11.77 m.).
Length 28 ft. 0½ in. (8.55 m.).
Height 9ft. 1 in. (2.77 m.).

WEIGHTS AND LOADINGS.—
Weight empty 3,289 lb. (1,492 kg.).
Removable equipment 34 lb. (15 kg.).
Crew (2) 400 lb. (182 kg.).
Fuel (69 Imp. gallons) and oil (5 Imp. gallons) 542 lb. (246 kg.).
Weight loaded 4,265 lb. (1,935 kg.).
Wing loading 17.1 lb./sq. ft. (83.45 kg./m.^{2}).
Power loading 9.58 lb./h.p. (4.34 kg./h.p.).



The Commonwealth CA-25 Winjeel.

PERFORMANCE.—
Max. speed 186 m.p.h. (299 km.h.).
Cruising speed at 8,500 ft. (2,590 m.) 165 m.p.h. (265 km.h.).
Rate of climb at T.O. power 1,500 ft./min. (458 m./min.).
Rate of climb at rated power 1,130 ft./min. (344 m./min.).
Climb to 5,000 ft. (1,525 m.) at rated power 4.6 min.
Climb to 10,000 ft. (3,050 m.) at rated power 10 min.
Service ceiling 18,000 ft. (5,490 m.).
Stalling speed (flaps down) 53 m.p.h. (85 km.h.).
Stalling speed (flaps up) 62 m.p.h. (100 km.h.).
Take-off distance (standard temp.) 540 ft. (165 m.).
Take-off distance (tropical temp.) 630 ft. (192 m.).
Take-off distance to clear 50 ft. (15.25 m.) (standard temp.) 1,110 ft. (338 m.).
Take-off distance to clear 50 ft. (15.25 m.) (tropical temp.) 1,260 ft. (384 m.).
Landing distance from 50 ft. (15.25 m.) (standard temp.) 1,000 ft. (305 m.).
Cruising endurance (69 Imp. gal.) 3½ hours at 158 m.p.h. (253 km.h.) at 5,000 ft. (1,525 m.).

DE HAVILLAND

THE DE HAVILLAND AIRCRAFT COMPANY (PTY.), LTD.

HEAD OFFICE AND WORKS: MILPERRA ROAD, BANKSTOWN, N.S.W.

Chairman: A. Murray-Jones, M.C., D.F.C.

Managing Director: Lester J. Brain, A.F.C.

Other Directors: J. J. Byrne and R. J. Vicars.

General Manager: D. H. McLachan.

The de Havilland Aircraft Pty., Ltd. was formed in Australia in 1927 to act as agents for the de Havilland Aircraft Co., Ltd., to build de Havilland aircraft under licence, to assemble new aircraft and to operate service stations for de Havilland products throughout Australia.

The de Havilland Vampire T. Mk. 33 jet trainer is currently in production at Bankstown. These aircraft are fitted with imported D.H. Goblin turbojet engines.

Since the production of Vampire Trainers began, complete overhaul facilities for the Goblin engine have been provided at the Bankstown factory. These jet engine overhaul shops also provide facilities for the Ghost engine which powers the Sea Venom carrier fighters in service with the Royal Australian Navy.

FAIREY

FAIREY AVIATION COMPANY OF AUSTRALASIA PTY. LTD.

REGISTERED OFFICE: 16, O'CONNELL STREET, SYDNEY, N.S.W.

WORKS: AIRPORT, BANKSTOWN, N.S.W.

POSTAL ADDRESS: PO. Box 41, BANKSTOWN, N.S.W.

Chairman and Managing Director: Raymond E. Purves.

General Manager: Air Commodore C. B. Wincott, C.B.E., R.A.F. (Retd.).

Secretary: J. R. Sainsbury.

This Company was founded under the name of the Fairey Clyde Aviation Co. Pty. Ltd. early in 1948, by the Fairey Aviation Co. Ltd. of Hayes, Middlesex, England and the Clyde Engineering Co. of Sydney, N.S.W.

In November, 1951 the name was changed to Fairey Aviation Company of Australasia Pty. Ltd. when the Clyde Engineering Company disposed of their holding. Mr. R. E. Purves, the original Chairman and Managing Director, continues in that position.

The Bankstown Works is carrying out overhauls, repairs and reconditioning of Fairey Firefly and Hawker Sea Fury aircraft of the Royal Australian Navy. It is also engaged in experimental work and aircraft conversions.

The Company is approved by both the Royal Australian Navy and the Department of Civil Aviation for design and for all classes of aircraft repair and manufacture.

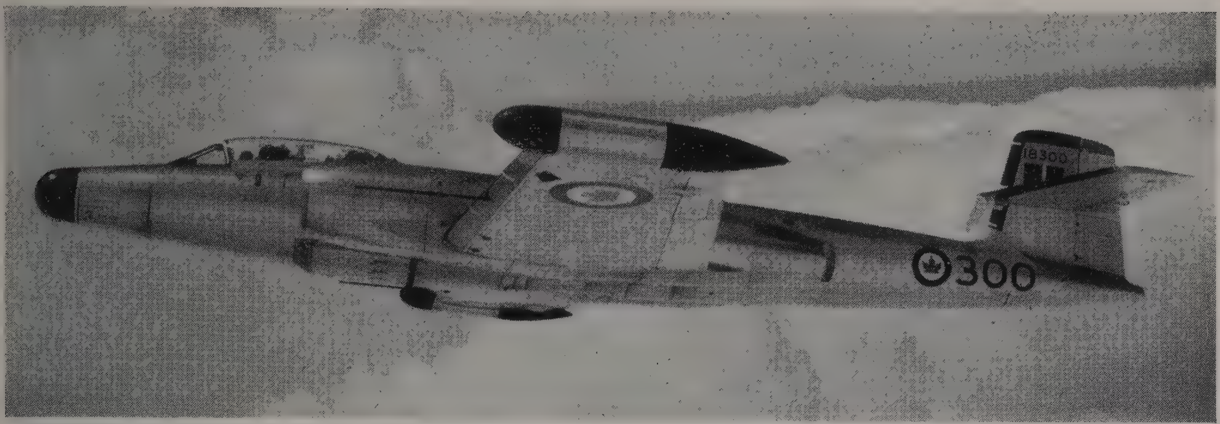
The Special Projects Division is located at Salisbury, South Australia, with Colonel R. T. Elvish as Manager. This Division is engaged on work in connection with the activities of the Rocket Range at Woomera, South Australia.

THE FIREFLY T. Mk. 5 TRAINER.

The first aircraft engineered by the Fairey Aviation Company of Australasia Pty. Ltd. is the Firefly T. Mk. 5, which has been evolved from the standard Firefly A.S. Mk. 5 anti-submarine aircraft used by the Royal Australian Navy. The most apparent modification is the provision of a raised cockpit for the instructor, complete with dual flying controls, in place of the standard observer's cockpit. This gives excellent forward view, especially for deck-landing instruction, without any adverse effect on performance.

With a top speed of 360 m.p.h. (576 km.h.) and an endurance of approximately 5½ hours, the Firefly T. Mk. 5 is the most advanced piston-engined trainer which has so far been produced in Australia.

AVRO



The Avro CF-100 Mk. 4 Two-seat All-weather Fighter (two Orenda turbojet engines) with wing-tip rocket pods.

AVRO AIRCRAFT LIMITED.

Head Office and Works: Malton, near Toronto, Ont.

Post Office Address: Box 4004, Terminal "A", Toronto, Ont.

Chairman and President: Crawford Gordon, Jr.

Vice-President and General Manager F. T. Smye.

Vice-President—Engineering: J. C. Floyd.

Vice-President—Manufacturing: H. R. Smith.

Vice-President—Sales and Service: J. A. Morley.

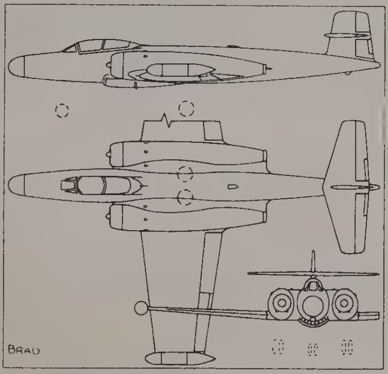
Secretary and Treasurer: J. Turner.

A. V. Roe Canada, Ltd., a member of the Hawker Siddeley Group, was formed in 1945 when it took over the Malton plant of the Government-owned Victory Aircraft, Ltd. This organisation eventually expanded into two divisions, one concentrating on airframes and the other on gas-turbine engines.

To meet the growing complexities and divergent airframe and aero-engine demands the two divisions have now been incorporated as separate companies with A. V. Roe Canada, Ltd. as the parent corporation.

The Aircraft Division began operating as a separate corporate entity under the name of Avro Aircraft, Ltd. on January 2, 1955.

Avro Canada's major achievements have been the design and development of two completely different types of aircraft, the C.102 Jetliner 40/60-passenger air-liner, which was the first jet-driven civil aircraft to fly on the American continent and the second in the entire World; and



The Avro CF-100 Mk. 4.

the CF.100 twin-jet long-range all-weather fighter, the third prototype of which, powered with two Orenda turbo-jet engines, was the first aircraft of wholly-Canadian design and construction to fly.

The CF-100, which was designed to meet an R.C.A.F. specification for a long-range all-weather day and night interceptor, is now in squadron service in Canada and in 1956 will re-arm four R.C.A.F. fighter squadrons in Europe.

The company's next major product will be the CF.105, a supersonic delta-wing all-weather interceptor.

THE AVRO CF.105

Avro has received a contract for the development and construction of two prototypes of the CF.105 twin-jet delta-wing all-weather fighter. The first prototype is expected to fly in 1956.

THE AVRO CF.100.

The CF.100 two-seat long-range all-weather fighter, which was designed to the requirements of the Royal Canadian Air Force, was the first aircraft to be wholly designed and built in Canada. By exceeding Mach. 1 in a dive from 30,000 ft. (9,150 m.) on December 18, 1952, the CF.100 achieved the distinction of being the first straight-wing combat aircraft to exceed the speed of sound. It is now in large-scale production for the Royal Canadian Air Force, the current production version being the Mk. 4.

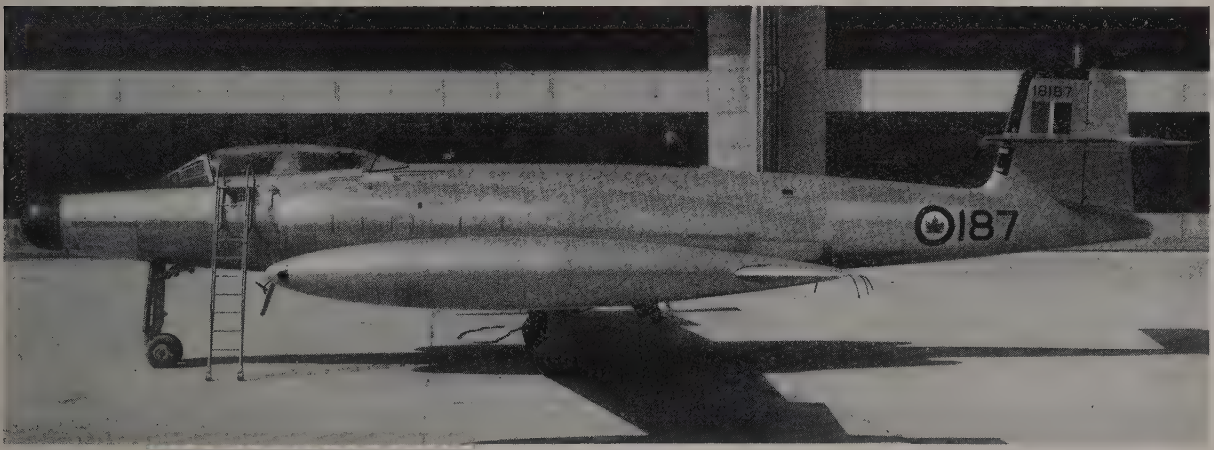
The following are the principal versions of the CF.100:—

Mark 1. Two Rolls-Royce Avon turbo-jet engines. Two prototypes built. First Mk. 1 flew for the first time on January 19, 1950.

Mark 2. Two Orenda turbojet engines. Pre-production unarmed model. Ten built. First Mk. 2 flew on June 20, 1951. One Mk. 2T with dual controls.

Mark 3. Two Orenda 9 turbojet engines. First production series. Seventy built. Fifty being converted into dual-control trainers. Armament: eight 0.50 in. (12.7 mm.) machine-guns in easily-replaceable ventral tray. First Mk. 3 flew on October 11, 1952.

Mark 4. Two Orenda 11 turbojet engines. Longer fuselage and revised nose shape. Armament consists of both 0.50 in. (12.7 mm.) machine-guns and rockets. Rocket armament carried in retractable pack in underside of fuselage and in wing-tip containers. Latest electronic equipment. Increased performance. Prototype Mk. 4 first flew on October 11, 1952, and the first production Mk. 4 on October 24, 1953.



The Avro CF-100 Mk. 4 (two Orenda turbojet engines) with long-range wing-tip fuel tanks.

The description below refers in the main to the CF.100 Mk. 4.

TYPE.—Two-seat All-weather Fighter.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 0010. Aspect ratio 5. Chord at root (transport joint) 12 ft. 2.9 in. (3.73 m.), at tip 6 ft. 11 in. (2.10 m.). Dihedral at datum 3°. Sweepback 25% chord line 1° 50′. All-metal structure. Leading-edge Goodrich de-icer boots. Total aileron area (including tabs) 28.53 sq. ft. (2.65 $m.^2$). Wing flap area (aft of hinge-line) 39.15 sq. ft. (3.64 $m.^2$). Centre section flap area (aft of hinge-line) 26.18 sq. ft. (2.43 $m.^2$). Dive-brake area (total of four) 41.76 sq. ft. (3.88 $m.^2$). Gross wing area 540 sq. ft. (50.16 $m.^2$).

FUSELAGE.—All-metal flush-rivetted monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Tailplane mounted halfway up fin. All-metal structure. Goodrich de-icer boots on fin and tailplane. Area of tailplane 83.76 sq. ft. (7.78 $m.^2$). Total elevator area (aft of hinge-line) 26.50 sq. ft. (2.46 $m.^2$). Rudder area (aft of hinge-line) 12.22 sq. ft. (1.13 $m.^2$). Fin area 31.53 sq. ft. (2.93 $m.^2$).

LANDING GEAR.—Retractable tricycle type. Dowty liquid-spring shock-absorber struts. Dunlop wheels and Dunlop brakes on main wheels. Track 10 ft. 2 in. (3.10 m.). Wheelbase 16 ft. 9.7 m. (5.11 m.).

POWER PLANT.—Two Orenda Mk. 11 axial-flow turbojet engines (over 7,000 lb.= 3,180 kg. s.t. each).

ACCOMMODATION.—Pressurised cockpit seating two in tandem, pilot in front, navigator/radar-operator behind. Sliding jettisonable canopy. Martin Baker Mk. 1E ejection seats for both members of crew.

DIMENSIONS.—
Span 53 ft. 7 in. (16.3 m.).
Length 54 ft. 2 in. (16.5 m.).
Height 15 ft. 6.4 in. (4.73 m.).

WEIGHTS.—
Weight loaded approx. 37,000 lb. (16,800 kg.).

PERFORMANCE.—
Operational range over 1,150 miles (1,840 km.).
Ceiling over 45,000 ft. (13,725 m.).

CAN-CAR

CANADIAN CAR & FOUNDRY CO., LTD.

HEAD OFFICE: 621, CRAIG STREET WEST, MONTREAL 3, P.Q.

AIRCRAFT WORKS: FORT WILLIAM, ONTARIO.

President and Managing Director: E. J. Cosford.

Vice-President, Purchasing: C. H. Drury.

Vice-President and Comptroller: L. A. Bruce.

Manager, Aircraft Division: R. E. Henderson.

Treasurer: K. S. Gordon.

Secretary: A. C. Lawson.

The Canadian Car & Foundry Co. Ltd., the largest manufacturers of railway equipment in the Dominion, entered the Canadian Aircraft Industry by acquiring from the Grumman Aircraft Engineering Corpn., of Bethpage, L.I., N.Y., the licence to construct the Grumman two-seat fighter biplane.

During the late war the Company held contracts with the Canadian, British and American Governments for the manufacture of several types of aircraft and details of its wartime activities have been given in previous issues of this Annual.

C.C.F. also acquired the principal assets of Noorduyn Aviation Ltd., when that company abandoned aircraft manufacture, and it built a number of Norseman single-engined general purposes aircraft for domestic and export requirements. Can-Car disposed of its interests in the Norseman in 1953.

Canadian Car & Foundry Co. Ltd. is licenced to build and supply to all countries, excluding the U.S.A., the North-American T-6 or Harvard. More than 500 Harvards have been delivered to the R.C.A.F. and various N.A.T.O. powers.

In 1953 the Canadian Car and Foundry Co., Ltd. was awarded a U.S.A.F. contract for the manufacture of an unspecified number of Beechcraft T-34A training aircraft. Production began in 1934.

The company is also engaged in sub-contract work for other firms in the Canadian aircraft industry.

At the time of closing for press, negotiations for the purchase of Canadian Car & Foundry Company, Ltd. by A. V. Roe, Canada, Ltd. were in progress.

CANADAIR

CANADAIR LIMITED.

HEAD OFFICE AND WORKS: CARTIERVILLE, AIRPORT, MONTREAL.

POSTAL ADDRESS: P.O. Box 6087, MONTREAL.

Chairman and Managing Director: John Jay Hopkins.

President and General Manager: J. Geoffrey Notman.

Vice-Chairman of the Board: Frank Pace, Jr.

Vice-Chairman of the Board: Lawrence B. Richardson.

Vice-President and General Counsel: John E. L. Duquet, Q.C.

Vice-President—Engineering: W. K. Ebel.

Vice-President—Manufacturing: Robert A. Neale.

Vice-President—Sales: Peter H. Redpath.

Vice-President and Comptroller: James F. Tooley.

Assistant to the Chairman of the Board—Communication: Vernon M. Welsh.

Assistant to the Chairman of the Board — Administration: Robert P. Meiklejohn.

Assistant to the Chairman of the Board—Finance: Lambert J. Gross.

Assistant to the Chairman of the Board—Legal Affairs: Roger I. Harris.

Assistant to the President: Dean P. Stowell.

Acting Secretary and Treasurer: John Urwin.

Director of Public Relations: Gordon J. Stringer.

Assistant Comptrollers: Frederick R. Kearns and Theodore C. Pawlett.

Canadair Ltd. was formed in 1944 to take over on a management fee basis the Crown plant on Cartierville Airport which had been built in 1942. In 1947, the company was acquired as a subsidiary by the Electric Boat Company (now General Dynamics Corporation) of New York, builders of the World's first nuclear-powered submarine. General Dynamics Corporation subsequently acquired from the Atlas Corporation 400,000 shares of its holdings of stock of the Consolidated Vultee Aircraft Corporation, and on March 1, 1954, the latter was merged with General Dynamics to become known as the Convair Division of the General Dynamics Corporation.

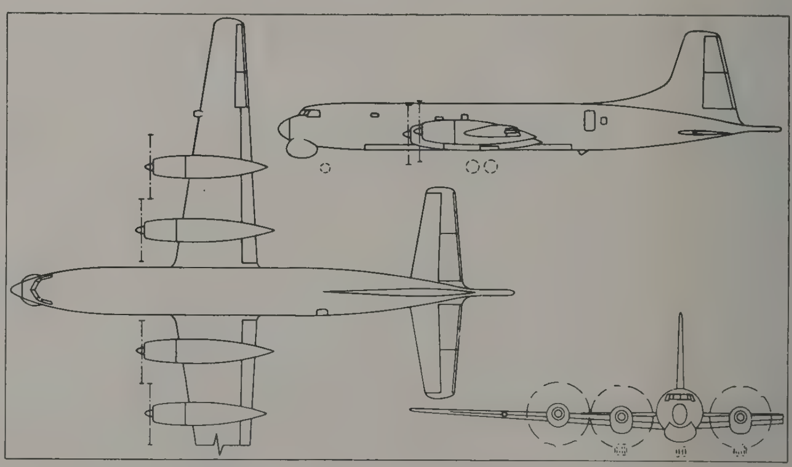
Canadair's first task was the designing and building of a four-engined transport aircraft to the requirements of the Royal Canadian Air Force and Trans-Canada Air Lines. Incorporating certain design features of the DC-4 and DC-6 and powered by four Rolls-Royce Merlin engines, the prototype first flew in July, 1946, following which a total of seventy-one were produced, including a later version, the Canadair Five. Purchasers included Trans-Canada Air Lines, the Royal Canadian Air Force, British Overseas Airways Corporation and Canadian Pacific Air Lines.

Since 1949, Canadair has been engaged almost exclusively in a programme of military aircraft production for the R.C.A.F., R.A.F. and the U.S.A.F. During 1949, quantity production of the Sabre single-seat fighter under licence from North American Aviation, Inc. was begun. By the Spring of 1955 more than 1,200 Sabres had been built by the Company, of which some 375 had been delivered to the R.A.F. under Mutual Aid.

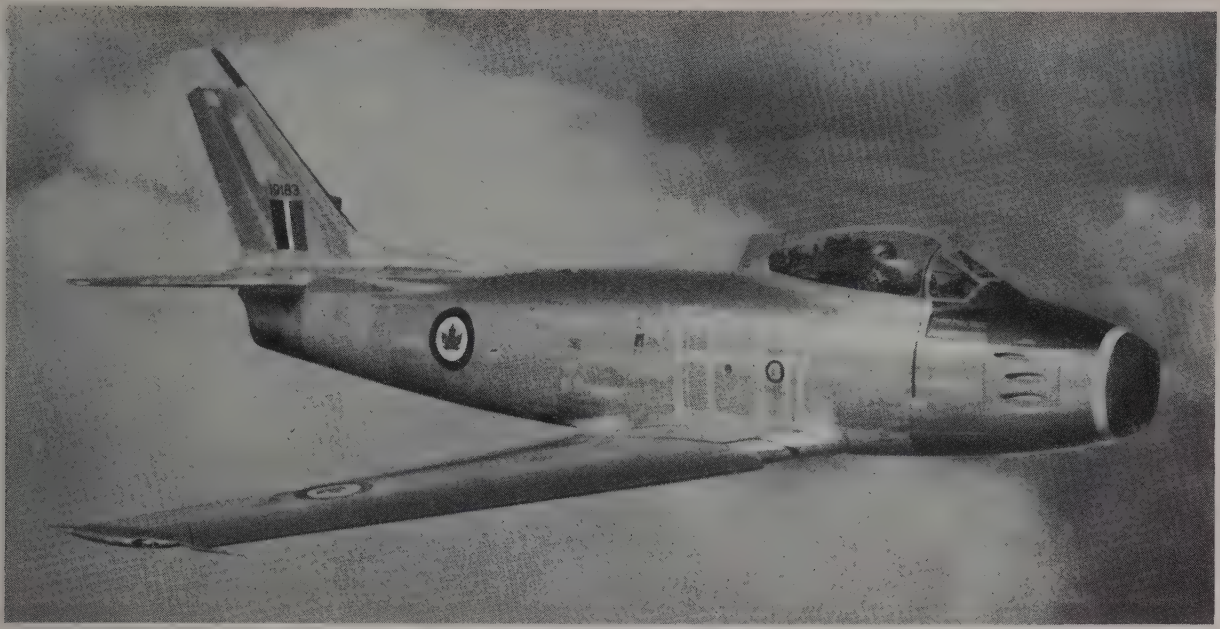
In addition to producing the Sabre for Canada, England, the United States, and NATO forces in Europe, Canadair's production includes the Silver Star two-seat jet trainer, of which more than 450 had been delivered to the R.C.A.F. by March, 1955. Built under a licence agreement from the Lockheed Aircraft Corporation, the Silver Star jet trainer is powered by a Rolls-Royce Nene engine.

In March, 1954, Canadair was awarded a contract from the Canadian Government to build a substantial number of four-engined maritime reconnaissance aircraft for the R.C.A.F. This aircraft, known as the CL-28, will be a military adaptation of the Bristol Britannia commercial transport and as such it will be the largest aircraft to be produced in Canada. The CL-28 will be powered by four Wright Turbo Compound piston engines and will be longer and heavier than the commercial Britannia. The first CL-28 is scheduled to be completed early in 1957.

In June, 1955, it was announced that the South African Government had bought sufficient Sabre Mk. 6 fighters to equip two squadrons of the South African Air Force.



The Canadair CL-28 Maritime Reconnaissance Monoplane.



The Canadair Sabre Mk. 5 Single-seat Fighter (Orenda 10 turbojet engine).

With recent additions and extensions to Canadair's three plants on the Cartierville airport, the total covered floor area is now 2,500,000 square feet. Employment in the Spring of 1955 was 7,000.

Canadair is participating with the Defence Research Board and the R.C.A.F. in the development of a guided missile. The first successful launching of this missile from an F-86 in flight was made in August, 1953.

THE CANADAIR CL-28.

The CL-28 is a modification of the basic design of the Bristol Britannia to meet R C.A.F. requirements for a long-range maritime reconnaissance aircraft.

The first CL-28 is scheduled for completion by the beginning of 1957.

The CL-28 will retain the principal aerodynamic and structural features of the Britannia, the wings, tail-unit and landing gear being basically identical to those of the original. The fuselage, while being structurally similar to that of the Britannia, will be unpressurised and considerably modified internally.

The power-plant will consist of four 3,500 h.p. Wright R-3350 Turbo Compound engines and the maximum fuel capacity will be 6,800 Imp. gallons (30,910 litres), which will make possible a maximum endurance of 24 hours at reconnaissance altitudes. No further details are available.

Dimensions.—
Span 142 ft. 2½ in. (43.38 m.).
Length 122 ft. 1½ in. (37.25 m.).
Height 36 ft. 8 in. (11.18 m.).

THE CANADAIR SABRE.

The Canadair Sabre is built under licence from North American Aviation, Inc. and production began in 1949 for the R.C.A.F.

The following are the principal versions of the Canadair Sabre :—

Sabre Mk. 1. Prototype only. Based on the F-86A. First flew on August 9, 1950.

Sabre Mk. 2. First production version for the R.C.A.F. Based on the F-86E with "all-flying" tail and powered by the General Electric J47 turbojet engine obtained from the U.S.A.

Sabre Mk. 3. Mk. 2 fitted with the Orenda 10 engine (6,500 lb. = 2,950 kg. s.t.). Prototype for the Mk. 5. First flew early in 1953. This aircraft flown by Miss Jacqueline Cochran established three World's records in May, 1953, the 15-kilometre straight-away speed record at 675.069 m.p.h. (1,087.068 km.h.); the 100-kilometre closed-circuit speed record at 652.163 m.p.h. (1,050.182 km.h.); and the 500-kilometre closed-circuit speed record at 589.969 m.p.h. (950.032 km.h.).

Sabre Mk. 4. Later production version of the Mk. 2, for the Royal Air Force.

Sabre Mk. 5. Powered by the Orenda 10 engine (6,500 lb. = 2,950 kg. s.t.) and fitted with the 6/3 wing first used by the F-86F. First production Mk. 5 flew on July 30, 1953.

Sabre Mk. 6. Development of Mk. 5 with higher-powered Orenda 14 engine with two-stage turbine (7,200 lb. = 3,270 kg. s.t.).

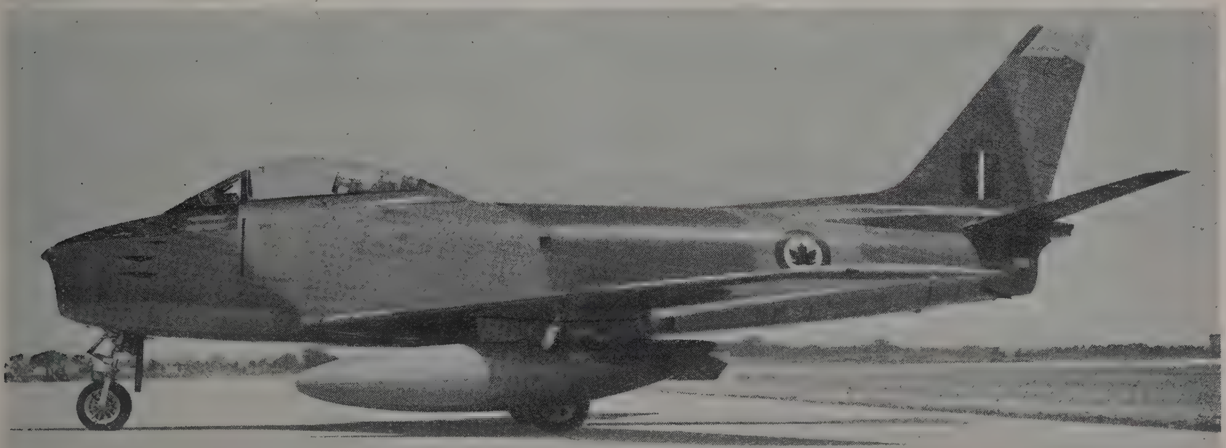
By March, 1955, more than 1,200 Canadair Sabres had been built and supplied to the R.C.A.F., R.A.F., U.S.A.F. and NATO forces in Europe.

A general description of the Sabre will be found under "North American" (U.S.A.), but details of the latest versions of the Canadian-built Sabre are not available for publication.

Dimensions (Sabre Mk. 6).—
Span 37 ft. 1½ in. (11.32 m.).
Length 37 ft. 6 in. (11.43 m.).
Height 14 ft. 9 in. (4.49 m.).

THE CANADAIR SILVER STAR.

The Silver Star, which is being built under a licence from the Lockheed Aircraft Corporation, is the T-33A two-seat jet trainer powered by a Rolls-Royce Nene 10 turbojet engine (5,100 lb. = 2,315 kg. s.t.). Canadair is manufacturing a substantial quantity for the R.C.A.F. The first Nene-powered Silver Star flew for the first time in October, 1952, and the first production aircraft was delivered to



The Canadair Sabre Mk. 6 Single-seat Fighter (Orenda 14 turbojet engine).

The Canadair Silver Star Two-seat Advanced Trainer (Rolls-Royce Nene turbojet engine).

the R.C.A.F. in January, 1953. By the Spring of 1955 more than 450 had been produced.

DIMENSIONS.—
Span 42 ft. 5 in. (12.93 m.).
Length 37 ft. 8 in. (11.48 m.).
Height 11 ft. 8 in. (3.55 m.).

THE CANADAIR FOUR.

The Canadair Four was designed in its earlier North Star versions, to meet the specifications established by T.C.A. and the R.C.A.F. Incorporating the airframe features of the Douglas DC-4 and DC-6 and powered by four Rolls-Royce Merlin 620 engines, twenty-four were produced for the Royal Canadian Air Force in a military version as the C-54GM, and twenty in a commercial pressurized version as the DC-4M2 for T.C.A.

The Canadair Four, or C-4, was the ultimate commercial development in this series. The fitting of Merlin 626 engines, rated at 1,760 h.p. for take-off, combined with increased airscrew efficiency, permitted an increase in the all-up gross weight from 73,000 to 82,300 lb. (33,140 to 37,300 kg.), with a corresponding improvement in payload for maximum range and range for maximum payload.

Twenty-six Canadair Fours were supplied to the British Overseas Airways Corporation and Canadian Pacific Air Lines.

TYPE.—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Aerofoil section NACA 23016/23012. Root incidence 4 degrees. Dihedral 7 degrees. Aspect ratio 9.48 : 1. All-metal structure with flush-riveted Alclad skin. Fuel tanks integral with wing. Flaps are single-slotted type, ailerons are metal-framed and fabric-covered. Gross wing area 1,457 sq. ft. (135.35 m.^{2}).

FUSELAGE.—Semi-monocoque all-metal flush-riveted structure, pressure-sealed to withstand a proof pressure of 5.55 lb./sq. in. (.388 kg./cm.^{2}).

TAIL UNIT.—Cantilever monoplane type. All-metal structure with metal-covered fixed surfaces and fabric-covered rudder and elevators. Total horizontal surface area 324.8 sq. ft. (30.17 m.^{2}), elevator area (aft of hinge line, including tabs) 86.1 sq. ft. (7.99 m.^{2}). Total vertical surface area (including fin extension) 153.6 sq. ft. (14.26 m.^{2}), rudder area (aft of hinge line, including tab) 47.3 sq. ft. (4.38 m.^{2}).

LANDING GEAR.—Retractable tricycle type with dual main wheels and steerable nose wheel. Hydraulic retraction. Hydraulic wheel brakes, with a compressed air system for use in emergency.

POWER PLANT.—Four Rolls-Royce Merlin 626 twelve-cylinder Vee pressure liquid-cooled engines with two-speed two-stage superchargers, each rated at 1,760 h.p. for take-off at sea level, 1,500 h.p. maximum continuous power at 7,750 ft. (2,360 m.) and 1,420 h.p. maximum continuous power at 18,750 ft. (5,720 m.). Hamilton Standard three-blade constant-speed quick-feathering reversible airscrews 13 ft. 1 in. (3.98 m.) diameter. Maximum fuel capacity 3,226 Imp. gallons (3,871 U.S. gallons = 14,680 litres).

ACCOMMODATION.—Pressurized accommodation for crew and passengers, giving sea-level cabin pressure when flying at 9,000 ft. (2,740 m.) and 8,000 ft. (2,440 m.) cabin pressure when flying at 20,000 ft. (6,100 m.). Cabin has automatic altitude regulation and temperature control. Standard crew consists of two pilots and two cabin attendants. For long-range operation, a radio operator and navigator may be added, together with crew rest area. Passenger compartment has standard daytime seating capacity of 40, which may be increased to 55 for short-range operation, or decreased to 36 to permit full recline, slumber-lounge type accommodation. An alternative interior arrangement with day capacity of 40 is convertible to a 20-passenger sleeper, each sleeper berth being equipped with reading lights, stowages and conditioned and cold air outlets. A galley is located adjacent to the main cabin entrance door.

DIMENSIONS.—
Span 117 ft. 6 in. (35.8 m.).
Length 93 ft. 7½ in. (28.6 m.).
Height 27 ft. 6$\frac{5}{16}$ in. (8.4 m.).

WEIGHTS AND LOADINGS.—
Manufacturer's weight empty 46,832 lb. (21,225 kg.).
Max. loaded weight 82,300 lb. (37,300 kg.).
Max. landing weight 70,000 lb. (31,750 kg.).
Wing loading (at max. take-off weight) 56.5 lb./sq. ft. (275 kg./m.^{2}).
Power loading (at max. take-off weight) 11.7 lb./h.p. (5.3 kg./h.p.).

PERFORMANCE (70,000 lb. = 31,700 kg. gross weight).—
Max. cruising speed (high blower, 1,136 h.p. per engine) 325 m.p.h. (520 km.h.) at 25,200 ft. (7,690 m.).
Max. cruising speed (low blower, 1,165 h.p. per engine) 289 m.p.h. (465 km.h.) at 12,200 ft. (3,720 m.).
Rate of climb at 20,000 ft. (6,100 m.) at max. continuous power 840 ft./min. (256 m./min.).
Service ceiling 29,500 ft. (9,000 m.).
Service ceiling on 3 engines 22,300 ft. (6,800 m.).
CAA take-off field length at sea level, 5,200 ft. (1,585 m.).

PERFORMANCE (at 82,300 lb. = 37,150 kg. gross weight).—
Max. cruising speed (high blower, 1,136 h.p. per engine) 302 m.p.h. (485 km.h.) at 25,200 ft. (7,690 m.).
Max. cruising speed (low blower, 1,165 h.p. per engine) 276 m.p.h. (444 km.h.) at 12,200 ft. (3,720 m.).
Rate of climb at 20,000 ft. (6,100 m.) at max. continuous power, 500 ft./min. (153 m./min.).
Service ceiling 25,200 ft. (7,690 m.).
Service ceiling on 3 engines 18,800 ft. (5,740 m.).
CAA take-off field length at sea-level 5,650 ft. (1,720 m.).

RANGE.—
Absolute range at 10,000 ft. (3,050 m.) 3,880 miles (6,240 km.) with 3,226 Imp. gallons (14,680 litres).

The Canadair Four Airliner (four 1,760 h.p. Rolls-Royce Merlin engines) in the colours of B.O.A.C.

The Canadair C-54GM North Star Transport (four 1,760 h.p. Rolls-Royce Merlin engines).

THE CANADAIR FIVE.

A larger and more powerful version of the North Star—the Canadair Five—was completed during 1950 for the Royal Canadian Air Force. Powered with four Pratt & Whitney R-2800 engines, this aircraft is used by the Air Force both as a long-range crew trainer, and as a private transport for the Canadian Prime Minister and other Government and military officials.

TYPE.—Four-engined Airliner.

WINGS and FUSELAGE.—Same as for Canadair Four.

TAIL UNIT.—Cantilever monoplane type as for Canadair Four. Total horizontal surface area 365.6 sq. ft. (33.96 m.²), elevator area (aft of hinge line including tabs) 108.9 sq. ft. (10.11 m.²). Total vertical surface area (including fin extension) 159.6 sq. ft. (14.82 m.²), rudder area (aft of hinge line, including tab) 49 sq. ft. (4.55 m.²).

LANDING GEAR.—Same as for Canadair Four.

POWER PLANT.—Four Pratt & Whitney R-2800-CA15 eighteen-cylinder radial engines, each rated at 2,100 h.p. for take-off at sea level, 1,800 h.p. rated power at 6,000 ft. (1,830 m.) and 1,600 h.p. at 16,000 ft. (4,880 m.). Max. fuel capacity 3,226 Imp. gallons (14,646 litres).

DIMENSIONS.—
- Span 117 ft. 6 in. (35.8 m.).
- Length 93 ft. 7½ in. (28.6 m.).
- Height 29 ft. (8.8 m.).

WEIGHTS AND LOADINGS.—
- Manufacturer's weight empty 49,475 lb. (22,461 kg.).
- Max. loaded weight 86,000 lb. (39,045 kg.).
- Max. landing weight 72,000 lb. (32,690 kg.).
- Wing loading (at max. take-off weight) 59.01 lb./sq. ft. (287.9 kg./m.²).
- Power loading (at max. take-off weight) 10.24 lb./h.p. (4.64 kg./h.p.).

PERFORMANCE (at 72,000 lb. = 32,690 kg.).—
- Max. cruising speed (high blower, 1,175 h.p. per engine) 318 m.p.h. (508.8 km.h.) at 20,400 ft. (6,220 m.).
- Max. cruising speed (low blower) 301 m.p.h. (484.6 km.h.) at 11,200 ft. (3,420 m.).
- Rate of climb at 20,000 ft. (6,100 m.) at max. rated power 955 ft./min. (291 m./min.).
- Service ceiling 29,500 ft. (9,000 m.).
- Service ceiling on three engines 24,400 ft. (7,440 m.).
- C.A.A. take-off field length at sea level 3,120 ft. (946 m.).

PERFORMANCE (at 86,000 lb. = 39,045 kg.).—
- Max. cruising speed (high blower, 1,175 h.p.) 303 m.p.h. (485 km.h.) at 20,400 ft. (6,220 m.).
- Max. cruising speed (low blower) 292 m.p.h. (467 km.h.) at 11,200 ft. (3,420 m.).
- Rate of climb at 20,000 ft. (6,100 m.) at max. rated power 570 ft./min. (174 m./min.).
- Service ceiling 26,200 ft. (7,990 m.).
- Service ceiling on three engines 20,000 ft. (6,100 m.).
- C.A.A. take-off field length at sea level 4,950 ft. (1,510 m.).
- Absolute range at 10,000 ft. (3,050 m.) with 3,226 Imp. gallons (14,646 litres) 3,985 miles (6,376 km.).

The Canadair Five Military Transport (four 2,100 h.p. Pratt & Whitney R-2800 engines).

DE HAVILLAND

THE DE HAVILLAND AIRCRAFT OF CANADA, LTD.

HEAD OFFICE AND WORKS: POSTAL STATION "L," TORONTO, ONTARIO.

Managing Director: P. C. Garratt.
Engineering Director: W. D. Hunter.
Sales Director: C. H. Dickins.
Sales Manager: A. F. MacDonald.
Production Manager: W. C. Burlison.
Secretary and Treasurer: G. J. Mickleborough.

The de Havilland Aircraft of Canada Ltd., was established early in 1928 by the de Havilland Aircraft Co., Ltd., as a Canadian constructional plant and service depot for D.H. aircraft.

The authorised capital of the Company is $500,000, of which $306,000 has been issued.

Considerable experimental work has been done in order to produce components and special accessories to meet all Canadian flying conditions.

Since the end of the war the company has flown three aircraft of original design—the DHC-1 Chipmunk two-seat trainer, the DHC-2 Beaver and the DHC-3 Otter, both single-engined cabin monoplanes designed for Canadian "bush" operations.

The Otter, which flew for the first time on December 12, 1951, received its Certificate of Airworthiness both as a landplane and seaplane in October, 1952, and thereupon became the first single-engined aircraft to qualify for approval in accordance with ICAO Category D airworthiness requirements.

The Otter has been in continuous

The DHC-3 Otter Utility Transport fitted with a combination wheel-ski landing-gear.

production since March, 1953, and a substantial number has been delivered to the Royal Canadian Air Force and the Royal Norwegian Air Force. A large quota of Otters delivered to the R.C.A.F. are engaged on Arctic Search and Rescue operation and aerial photographic duties. Commercially, Otters are operating over a wide range of climatic conditions, including territories such as Norway, Colombia and the Philippine Islands.

Early in 1955 D.H. Canada began production on a substantial quantity of Otters for the U.S. Army. The first six were delivered on March 14, 1955, and assigned to topographical survey duties in Alaska, while the second six were flown to the Panama Canal Zone. Designated U-1 by the U.S. Army, Otters will also be used as supply aircraft in forward areas for transporting cargo, troops, paratroops, etc., and for casualty evacuation. The Otter has also been produced for the U.S. Navy.

By the end of 1954 a total of more than 700 military and civil Beavers had been built, the majority of the military Beavers being for delivery to the U.S. Air Force and Army. The Beaver is now in wide use throughout Canada and in 35 foreign countries. Production contracts will maintain schedules at current levels until the end of 1955.

The de Havilland Aircraft of Canada, Ltd. has been awarded a prime contract to build the Grumman S2F twin-engined anti-submarine monoplane under licence for the Royal Canadian Navy. Delivery of the first D.H.-built CS2F's is expected to take place in 1956.

THE DHC-3 OTTER.

U.S. Army designation: U-1.
U.S. Navy designation: UC-1.

Type.—Single-engined nine/fourteen-passenger General Utility Transport.

Wings.—High-wing braced monoplane. D.H. high-lift wing section. Aspect ratio 8.97. Dihedral 2°. All-metal structure. Single bracing strut on each side. Slotted inset ailerons. Double slotted flaps. Ailerons and flaps all-metal. Total aileron area 26.3 sq. ft. (2.44 m.²). Total area of flaps 98 sq. ft. (9.10 m.²). Gross wing area 375 sq. ft. (34.84 m.²).

Fuselage.—Of conventional all-metal structure.

Tail Unit.—Cantilever monoplane type with tailplane halfway up fin which is integral with fuselage. All-metal structure. Total vertical area 60.2 sq. ft. (5.6 m.²). Total horizontal area 84.0 sq. ft. (7.8 m.²). Span of tail 21 ft. 2 in. (6.46 m.).

Landing Gear.—Interchangeable wheels, floats or skis. Wheel gear has D.H. rubber-in-compression springing. Goodyear wheels and brakes. Track 11 ft. 2 in. (3.42 m.). Wheelbase 27 ft. 10 in. (8.49 m.). Wheels interchangeable with D.H. skis or twin Edo 7170 all-metal single-step floats. Float base (C/L. of floats) 10 ft. 6 in. (3.20 m.). A combination wheel-ski landing-gear designed and manufactured by D.H. is available. The change from wheels to skis or *vice versa* is accomplished from the cockpit by hydraulic pump.

Power Plant.—One 600 h.p. Pratt & Whitney R-1340-S1H1-G or S3H1-G radial air-cooled engine driving a three-blade Hamilton Standard Hydromatic airscrew 11 ft. (3.35 m.) diameter. Special exhaust system with four augmenter stacks. In these stacks exhaust gases produce suction strong enough to pull cooling air through engine and from behind engine accessories compartment while at same time providing measurable amount of thrust in cruising flight. Engine is effectively cooled during steep climbs when forward air speed is low and engine output near its maximum. Fuel tanks under cabin floor. Capacities: front 51 Imp. gallons (230 litres), middle (two cells) 85 Imp. gallons (386 litres), rear 42 Imp. gallons (190 litres). Total internal fuel capacity: 178 Imp. gallons (830 litres). Oil capacity 9 Imp. gallons (41 litres). Oil dilution system. Remote control fire-extinguisher system in engine compartment.

Accommodation.—Pilot's compartment seats two side-by-side, pilot (port) and co-pilot or passenger. Dual rudder pedals and W-type control column with throw-over wheel. Door on each side and one in bulkhead to cabin. Cabin is 16 ft. 5 in. (5.0 m.) long, 5 ft. 2 in. (1.58 m.) wide and 4 ft. 11 in. (1.5 m.) high, divided by bulkhead into 12 ft. 8 in. (3.8 m.) long main passenger

The DHC-3 Otter (600 h.p. Pratt & Whitney R-1340 engine) as supplied to the U.S. Army.

The DHC-3 Otter Seaplane (600 h.p. Pratt & Whitney R-1340 engine), here seen in R.C.A.F. colours.

or freight compartment and stowage compartment. Volume of main compartment 272 cub. ft. (7.6 m.³), of stowage compartment 38 cub. ft. (1.06 m.³). Doors on each side of main compartment 46.5 in. (118 cm.) wide on port, 30 in. (76.2 cm.) wide on starboard. Reinforced cargo floor. Cargo drop hatch, camera hole or paratroop exit in floor of stowage compartment. standard seating accommodation 9 passengers in cabin, plus one in cockpit. Optional seating—up to 13 passengers on folding bench seats on sides of cabin, plus one in cockpit. Alternatively, 6 stretchers and 4 passenger seats or 3 stretchers and 7 passenger seats. All seats quickly removable.

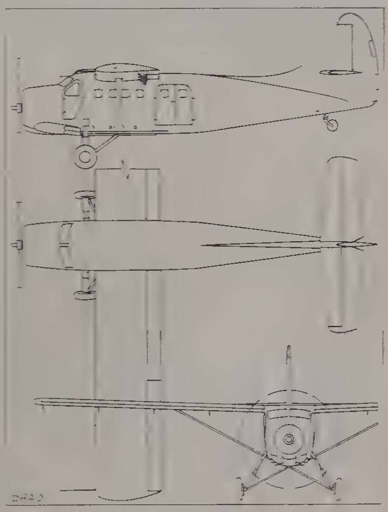
Equipment.—A 28-volt electrical system charged by a 50 or 100 amp. generator is provided. Navigation lights, controllable-intensity instrument lights, a 250-watt sealed-beam landing-light in the port wing leading-edge and cabin lights are provided. Racks in the stowage compartment give accessible installation to the battery and to radio and navigation equipment specified by the operator.

Dimensions.—
- Span 58 ft. (17.69 m.).
- Length (landplane and seaplane) 41 ft. 10 in. (12.80 m.).
- Height (landplane) 12 ft. 7 in. (3.83 m.).
- Height (seaplane) 15 ft. 0 in. (4.57 m.).

Weights.—
- Weight empty (landplane) 4,094 lb. (1,860 kg.).
- Weight empty (seaplane) 4,526 lb. (2,055 kg.).
- Weight empty (fixed skis) 4,332 lb. (1,970 kg.).
- Weight empty (wheel/ski gear) 4,400 lb. (2,000 kg.).
- Weight loaded (landplane) 8,000 lb. (3,630 kg.).
- Weight loaded (seaplane) 7,967 lb. (3,613 kg.).

Performance (Landplane).—
- Max. true level speed (600 h.p.) 160 m.p.h. (257 km.h.) at 5,000 ft. (1,525 m.).
- True cruising speed (400 h.p.) 138 m.p.h. (222 km.h.) at 5,000 ft. (1,525 m.).
- Rate of climb (600 h.p.) 850 ft./min. (260 m./min.).
- Service ceiling (S1H1-G engine) 18,800 ft. (573 m.).
- Service ceiling (S3H1-G engine) 17,400 ft. (530 m.).
- Max. range (full tanks) 960 miles (1,545 km.) at 5,000 ft. (1,525 m.).
- Max. endurance 9.8 hours at 5,000 ft. (1,525 m.).
- Take-off distance to 50 ft. (15.25 m.) (no wind) 1,302 ft. (397 m.).
- Landing distance from 50 ft. (15.25 m.) 1,225 ft. (374 m.).

Performance (Seaplane).—
- Max. true level speed (600 h.p.) 153 m.p.h. (245 km.h.) at 5,000 ft. (1,525 m.).
- True cruising speed (400 h.p.) 120 m.p.h. (207 km.h.) at 5,000 ft. (1,525 m.).



The DHC-3 Otter.

- Rate of climb 750 ft./min. (229 m./min.).
- Service ceiling (S1H1-G engine) 17,900 ft. (5,450 m.).
- Service ceiling (S3H1-G engine) 16,400 ft. (5,000 m.).
- Max. range (full tanks) 863 miles (1,385 km.) at 5,000 ft. (1,525 m.).
- Max. endurance 8.8 hours at 5,000 ft. (1,525 m.).
- Take-off distance to 50 ft. (15.25 m.) 1,980 ft. (605 m.).
- Landing distance from 50 ft. (15.25 m.) 1,510 ft. (460 m.).

Performance (Skiplane).—
- Max. true level speed (600 h.p.) 158 m.p.h. (254 km.h.) at 5,000 ft. (1,525 m.).
- True cruising speed (400 h.p.) 133 m.p.h. (214 km.h.) at 5,000 ft. (1,525 m.).
- Service ceiling (S3H1-G engine) 17,100 ft. (5,200 m.).
- Service ceiling (S1H1-G engine) 18,600 ft. (5,670 m.).
- Rate of climb (600 h.p.) 800 ft./min. (24.4 m./min.).

Note.—Range and endurance include allowances for 10 min. warm-up, take-off, climb to 5,000 ft. (1,525 m.) and fuel for 45 minutes at cruise power in reserve.

THE DHC-2 BEAVER.

U.S. Army and U.S.A.F. designation: L-20.

Type.—Single-engined seven-seat landplane, seaplane or skiplane which may be used for military liaison and communications, military and civil cargo transportation, ambulance and rescue duties and civil agricultural and forestry operations.

Wings.—High-wing braced monoplane. D.H. high-lift wing section. All-metal two-spar structure. Single bracing struts on each side. Entire trailing-edge hinged. Slotted ailerons and flaps interconnected so that when flaps are lowered to maximum angle of 58° the ailerons droop progressively to about 15° while retaining full lateral control. Hydraulic flap operation. Gross wing area 250 sq. ft. (23.2 m.²).

Fuselage.—Rectangular all-metal structure.

Tail Unit.—Cantilever monoplane type. All-metal structure including covering.

Landing Gear.—Interchangeable floats, wheels and skis. Rubber-in-compression cantilever single-leg wheel gear with steerable tail-wheel. Goodyear wheels and brakes. Twin Edo Model 58-4580 all-metal floats. Float base (C/L of floats) 9 ft. 6¾ in. (2.92 m.). A combination wheel-ski

The DHC-2 Beaver as supplied to the U.S. Army.

gear designed and manufactured by D.H. is also available. The change-over from wheels to skis or *vice versa* is accomplished from the cockpit by hydraulic pump.

Power Plant.—One 450 h.p. Pratt & Whitney R-985 Wasp Junior nine-cylinder radial air-cooled engine driving a two-blade Hamilton Standard controllable-pitch airscrew 8 ft. 6 in. (2.59 m.) diameter. Fuel tanks (3) are under the cabin floor and easily removable for servicing. Tank fillers in fuselage sides to permit refuelling from ground or floats. Maximum internal fuel capacity 79 Imp. gallons (359 litres). Provision for wing-tip tanks of 36 Imp. gallons (165 litres) capacity. Oil tank and cooler in engine compartment aft of firewall. Oil-dilution system. Hand and electric starters. Remote-control fire-extinguishing system in engine compartment in civil version only.

Accommodation.—Pilot's compartment with pilot on port side and removable seat on starboard. Dual rudder pedals and Y-type control column with throw-over wheel. Entrance door with automobile-type sliding windows on each side. Cabin may seat seven passengers. Cabin heating. Floor stressed for freight-carrying. Lightweight collapsible bush-seats are interchangeable with cargo attachments. Two side doors, one on each side, wide enough to roll a 45-gallon petrol drum into cabin on its side. Hatches in rear wall of cabin to enable long pieces of freight, such as 10 ft. drilling-rods, to be loaded and stowed. Adequate baggage space at back of cabin, with separate locker aft for emergency rations, etc. Total cabin capacity 144 cub. ft. (4.07 $m.^3$). Capacity available for freight payload 120 cub. ft. (3.35 $m.^3$).

Equipment.—24-volt electrical system charged by engine-driven 1,500-watt generator. Batteries in rear fuselage on removable tray accessible through fuselage side. Provision for navigation lights, instrument lighting, anchor riding light and cabin lights. Fittings on floats chassis for 16 ft. canoe. Extra equipment to operators' specifications include radio, agricultural spraying or dusting equipment, etc.

Dimensions.—
- Span 48 ft. (14.64 m.).
- Length (landplane) 30 ft. 3 in. (9.22 m.).
- Length (seaplane) 32 ft. 9 in. (9.98 m.).
- Height (landplane) 9 ft. 0 in. (2.75 m.).
- Height (seaplane) 10 ft. 5 in. (3.18 m.).

Weights (Landplane).—
- Weight empty 2,827 lb. (1,280 kg.).
- Weight loaded 5,100 lb. (2,300 kg.).

Weights (Seaplane).—
- Weight empty 3,118 lb. (1,412 kg.).
- Weight loaded 5,100 lb. (2,300 kg.).

Performance (Landplane).—
- Max. true level speed (450 h.p.) 163 m.p.h. (262 km.h.) at 5,000 ft. (1,525 m.).
- True cruising speed (300 h.p.) 143 m.p.h. (230 km.h.) at 5,000 ft. (1,525 m.).
- Rate of climb (450 h.p.) 1,020 ft./min. (311 m./min.).
- Service ceiling 18,000 ft. (5,490 m.).
- Cruising range (240 h.p.—internal fuel only) 455 miles (724 km.) at 5,000 ft. (1,525 m.).
- Cruising range (240 h.p.—with wing-tip tanks) 740 miles (1,190 km.) at 5,000 ft. (1,525 m.).
- Take-off distance to 50 ft. (15.25 m.) 1,250 ft. (381 m.).
- Landing distance from 50 ft. (15.25 m.) 1,250 ft. (380 m.).

The DHC-2 Beaver Skiplane (450 h.p. Pratt & Whitney R-985 engine).

The DHC-2 Beaver Seaplane with Edo Model 58-4580 metal floats.

Performance (Seaplane).—
- Max. true level speed (450 h.p.) 151 m.p.h. (243 km.h.) at 5,000 ft. (1,525 m.).
- True cruising speed (300 h.p.) 127 m.p.h. (204 km.h.) at 5,000 ft. (1,525 m.).
- Rate of climb (450 h.p.) 965 ft./min. (294 m./min.).
- Service ceiling 15,750 ft. (4,810 m.).
- Cruising range (internal fuel only) 405 miles (652 km.).
- Cruising range (with wing-tip tanks) 655 miles (1,052 km.).
- Take-off distance to 50 ft. (15.25 m.) 1,610 ft. (491 m.).
- Landing distance from 50 ft. (15.25 m.) 1,510 ft. (460 m.).

Note.—Ranges include allowance for 10 minute warm-up, take-off, climb to 5,000 ft. and reserve fuel for 45 minutes flight at cruise power.

THE DHC-2 BEAVER AMPHIBIAN.

An amphibian gear has been designed for use with the Edo Model 58-4580 floats currently fitted to the Beaver. This gear makes use of the standard main wheels and brakes with which the landplane is normally fitted.

The main wheels are suspended below the floats aft of the step on levered rubber shock-absorbers and retract into wells in the floats. Functioning components of the shock-absorbing and retracting systems are completely enclosed within the float shell and are not exposed to water.

A nose-wheel unit is mounted on the front bulkhead of each float and when not in use is rotated up and over to lie on the float deck. A levered rubber shock-absorbing system is also used in the nose-wheel installation. The nose-wheels are free-swivelling and are fitted with ante-shimmy twin-contact tyres. A centering lock is also provided for each nose-wheel to prevent misalignment when in the retracted position.

Retraction is by hydraulic jacks at each wheel unit, operated from a hand-pump and selector control in the cockpit. Both main and nose-wheel systems are fitted with mechanical down-locks, which are automatically released for the retraction cycle. A position indicator is fitted on the cockpit control unit.

Compared with the standard seaplane, the Beaver amphibian suffers no measurable penalty in performance. Fully loaded and in zero wind, the amphibian is airborne in 300 yds. (275 m.). As a landplane the amphibian taxis and handles easily and take-off and landing distances are affected only slightly. Fully-loaded and in zero wind the take-off is accomplished in 230 yds. (215 m.).

The DHC-2 Beaver Float Amphibian.

THE DHC-2 BEAVER Mk. 2.

The Beaver Mk. 2 is powered by an Alvis Leonides Series 502/4 engine developing 100 h.p. more than the Wasp fitted in the Mk. 1. Performance is correspondingly improved.

Type.—Same as for Mk.1.

Wings.—High-wing braced monoplane as for Mk. 1 with the exception that the wing incidence has been increased from zero to + 2°.

Fuselage.—All-metal structure as for Mk. 1.

Tail Unit.—All-metal structure. Increased fin and rudder area. Rudder trim-tab.

Landing Gear.—As for Mk. 1.

Power Plant.—One 570 h.p. Alvis Leonides Series 502/4 nine-cylinder radial air-cooled engine. D.H. three-blade Hydromatic airscrew 9 ft. (2.74 m.) diameter. Fuel system as for Mk. 1, including long-range tip tanks.

Accommodation.—As for Mk. 1.

Dimensions.—
- Span 48 ft. 8 in. (14.83 m.).

Length 31 ft. 9 in. (9.68 m.).
Height 9 ft. 11½ in. (3.04 m.).

Weights.—
Weight empty 3,145 lb. (1,428 kg.).
Payload with 250 mile = 400 km. cruise range, plus full fuel allowances 1,350 lb. (613 kg.).
Weight loaded 5,100 lb. (2,313 kg.).

Performance.—
Max. speed at 5,000 ft. (1,525 m.) 172 m.p.h. (276 km.h.).
Cruising speed at 10,000 ft. (3,050 m.) 155 m.p.h. (248 km.h.).
Initial rate of climb 1,460 ft./min. (446 m./min.).
Climb gradient (max. continuous power) 16%.
Service ceiling 21,300 ft. (6,500 m.).
Absolute range 1,000 miles (1,600 km.).
Measured take-off distance to 50 ft. = 15.25 m. (fully-loaded, zero wind) 754 ft. (230 m.).
Measured landing distance from 50 ft. = 15.25 m. 758 ft. (231 m.).

The DHC-2 Beaver Mk. 2 (570 h.p. Alvis Leonides engine).

THE DHC-1 CHIPMUNK.

The Chipmunk, out of production in Canada since 1951, is again being built. A substantial number is being produced for the R.C.A.F., first deliveries of the new order taking place in July, 1955.

Type.—Two-seat primary trainer.

Wings.—Cantilever low-wing monoplane. High-lift wing section based on NACA 2415 and U.S.A. 35B with increased camber towards tips. Aspect ratio 6.82. Taper ratio 2.1 : 1. Incidence 2°. Dihedral 5°. All-metal single-spar structure with stressed-skin D-section leading-edge and fabric-covering aft of spar. Auxiliary spar carries flaps and ailerons. Metal-framed fabric-covered slotted ailerons with metal trim-tab adjustable on ground. All-metal slotted flaps inboard of ailerons. Flap area 22 sq. ft. (2.03 m.²). Total aileron area 14 sq. ft. (1.3 m.²). Gross wing area 172.5 sq. ft. (16.01 m.²).

Fuselage. — All - metal semi - monocoque structure.

Tail Unit.—Cantilever monoplane type. Aerodynamically-balanced rudder and elevators with fabric-covering and metal trim-tab in each. Rudder tab adjustable on ground, elevator tabs controllable from cockpits.

Landing Gear.—Fixed tail-wheel type. Rubber - in - compression shock - absorber struts. Tail-wheel on levered-suspension unit with air/oil springing. Track 8 ft. 9 in. (2.66 m.).

Power Plant. One 145 h.p. D.H. Gipsy Major four-cylinder in-line inverted air-cooled engine. Two-blade fixed-pitch wood or Fairey-Reed metal (optional) airscrew. Fuel capacity 25 Imp. gallons (114 litres) in two wing tanks. Oil capacity 2¾ Imp. gallons (11.4 litres).

Accommodation.—Tandem cockpit with dual controls under sliding one-piece "bubble" canopy.

Dimensions.—
Span 34 ft. 4 in. (10.46 m.).
Length 25 ft. 5 in. (7.75 m.).
Height 7 ft. (2.134 m.).

Weights and Loadings.—
Weight empty 1,158 lb. (526 kg.).
Crew (2) and parachutes 380 lb. (172.6 kg.).
Fuel and oil 204.8 lb. (93 kg.).
Miscellaneous 157.2 lb. (7.3 kg.).
Total disposable load 772 lb. (350 kg.).
Weight loaded 1,930 lb. (875 kg.).
Wing loading 11.2 lb./sq. ft. (54.7 kg./m.²).
Power loading 13.8 lb./h.p. (6.15 kg./h.p.).

Performance (fixed-pitch airscrew).—
Max. speed at S/L. 139 m.p.h. (223 km.h.).
Cruising speed at S/L. 124 m.p.h. (200 km.h.).
Max. diving speed 200 m.p.h. (320 km.h.).
Rate of climb at S/L. 900 ft./min. (275 m./min.).
Service ceiling 17,200 ft. (5,242 m.).
Absolute ceiling 19,400 ft. (5,913 m.).
Stalling speed (flaps down) 50 m.p.h. (80 km.h.).
Stalling speed (flaps up) 55 m.p.h. (88 km.h.).
Take-off run (zero wind) 150 yds. (137 m.).
Endurance 2.3 hours.

Performance (Fairey-Reed airscrew).—
Max. speed at S/L. 140 m.p.h. (225 km.h.).
Speed at 5,000 ft. (1,525 m.) 134 m.p.h. (216 km.h.).
Cruising speed 124 m.p.h. (200 km.h.).
Rate of climb at S/L. 900 ft./min. (275 m./min.).
Service ceiling 17,200 ft. (5,243 m.).
Absolute ceiling 19,400 ft. (5,913 m.).
Take-off distance to 50 ft. (15.25 m.) 290 yds. (265 m.).
Landing distance from 50 ft. (15.25 m.) 310 yds. (283 m.).
Still-air range 485 miles (780 km.).

The DHC-1 Chipmunk (145 h.p. D.H. Gipsy-Major engine).

FAIREY

FAIREY AVIATION COMPANY OF CANADA LTD.

Head Office and Principal Plant: Eastern Passage, Halifax, N.S.

Western Division Plant: Patricia Bay Airport, Sidney, B.C.

President: Sir Richard Fairey, M.B.E., F.R.Ae.S.

Vice-President: Shirley G. Dixon.

Managing Director: Charles Hibbert, M.B.E.

Chief Designer: E. C. Garrard, A.M.I. Mech.E., A.F.R.Ae.S., A.F.C.A.I.

Secretary and Treasurer: A. M. Cameron.

The Fairey Aviation Co. of Canada, Ltd. was formed in November, 1948, initially to undertake the maintenance, overhaul and repair of aircraft for the Royal Canadian Navy.

Progress beyond these beginnings at the Eastern Passage plant has now resulted in the establishment of a second facility at Patricia Bay Airport, Sidney, British Columbia, with a similar initial object. The Western Canadian plant was opened on March 15, 1955.

At the company's principal plant design work on the conversion of the Grumman TBM-3E Avenger to suit the anti-submarine requirements of the Royal Canadian Navy which started in 1950, has now advanced during the past five years through two major developments so that the latest converted aircraft provide for all operational equipment likely to be required by the R.C.N. during the life of these aircraft.

The original conversion of a number of Lancaster Mk. 10 aircraft into long-range navigational trainers for the Royal Canadian Air Force which the company undertook in 1951 has followed a similar course of expansion. The company has more recently undertaken modification and conversion work to three other varieties of the Lancaster Mk. 10.

The R.C.A.F. is now taking delivery of a quantity of Lockheed Neptune aircraft and Fairey Canada will be responsible for modification and maintenance work on these aircraft.

Repair and maintenance of the R.C.N. Sea Furies continues and a modest R.C.N. modification programme has been developed for this type.

Modifications are also being undertaken to the rotary-wing aircraft which are operated by the R.C.N.

Deliveries of Fairey hydro-booster units for all three control surfaces of the Avro CF-100 all-weather fighter are now being made.

The labour force at the Eastern Passage plant remains fairly constant at just below 1,000, while that at the Western plant is in the stage of initial build-up.

With the advent of increased use of rotary-wing aircraft, the company is making plans for the manufacture of such aircraft in Canada.

FLEET

FLEET MANUFACTURING, LIMITED.

Head Office and Works: Fort Erie, Ontario.

President and General Manager: Herman L. Eberts.

Secretary and Treasurer: N. Ellwood Butler.

Fleet Aircraft, Ltd. was incorporated under a Dominion charter in 1930 to manufacture the Fleet Trainer, the exclusive World rights for the construction of which were obtained from the Consolidated Aircraft Corporation.

The Fleet Trainer, known in Canada as the Finch, was adopted by the R.C.A.F. for primary training and was later used in the British Commonwealth Air Training Plan. By 1941 over 600 Finches had been built.

The Finch was followed by the Fairchild PT-26, or Cornell, and Fleet built some 3,000 Cornells between 1942 and 1944.

After the war Fleet introduced the Model 80 Canuck, a light two-seat cabin monoplane, but the company was unable to weather the post-war recession and it dropped out of the aircraft industry to devote its attention to the manufacture of consumer goods and other non-aeronautical products. The name of the company was then changed to Fleet Manufacturing, Limited.

In 1953 the company re-entered the aircraft industry by undertaking the manufacture under sub-contract of major airframe components for Canadair, Ltd., A. V. Roe Canada, Ltd., de Havilland Aircraft of Canada, Ltd., and the Republic Aviation Corporation, as well as parts and assemblies for other contractors to the aircraft industry.

In 1954 a subsidiary, jointly owned by Fleet & Doman Helicopters, Inc. of Danbury, Connecticut, U.S.A., and known as Doman-Fleet Helicopters, Ltd. was formed to build and market the Doman LZ-5 eight-seat helicopter in Canada. The first Fleet-built LZ-5, shown alongside, was flown for the first time on June 4, 1955. For details of the LZ-5 see under "Doman" (U.S.A.).

The first Fleet-built Doman LZ-5 Helicopter.

Fleet is also licenced by the Helio Aircraft Corporation of Boston, Mass., U.S.A., to build the Helio Courier four-seat cabin monoplane and to sell it in Canada and the British Commonwealth. The first Courier to be manufactured and assembled in Canada made its first flight on February 1, 1955. This aircraft, after receiving its Canadian C. of A. has been used as a company demonstrator. For details of the Courier see under "Helio" (U.S.A.).

KAMAN

KAMAN AIRCRAFT OF CANADA, LTD.

Head Office: St. Catherines, Ontario.
President: Charles H. Kaman.
Vice-President, Engineering: John Emerson.
Managing Director: Gerald R. Wooll.
Secretary: Philip H. Sullivan.
Treasurer: Bruce F. Clark.

Kaman Aircraft of Canada, Ltd. has been formed as a fully-owned subsidiary by the Kaman Aircraft Corporation, of Bloomfield, Conn., U.S.A., so as to be in a position to enter the Canadian helicopter market when the time is propitious. Full details of Kaman helicopters will be found under "Kaman" (U.S.A.).

INDIA

HINDUSTAN

HINDUSTAN AIRCRAFT LTD.

Head Office and Works: Bangalore (Mysore State).

Chairman of the Board of Directors: W. N. Vellodi, Secretary, Ministry of Defence, Government of India.

Managing Director and General Manager: J. M. Shrinagesh, C.I.E., I.C.S.

Deputy General Manager: R. Natarajan.

Chief Designer: Dr. V. M. Ghatage, M.Sc., D.Phil., A.F.R.Ae.S., M.I.Ae.S., F.A.Sc., A.M.I.E., F.Ae.S.I.

Financial Manager: V. G. Kamath.

Production Adviser: J. J. M. Dziewonski, A.M.I.Mech.E., A.F.R.Ae.S., M.S.A.E.

Factory Manager: Albert Zampolino.

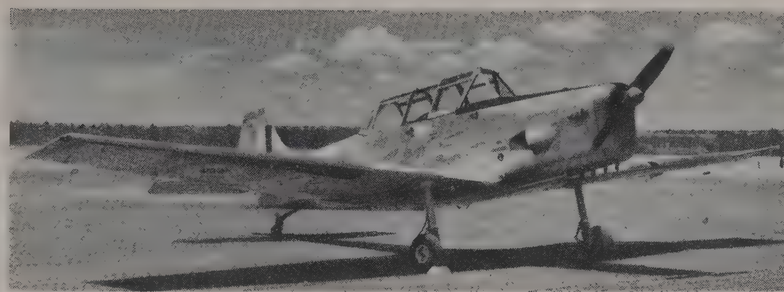
Hindustan Aircraft Ltd., was formed in 1940 to undertake the manufacture of aeroplanes for the Indian market. The capital of the Company was originally held jointly by the Government of India, the Mysore Government and Mr. Walchand Hirachand. To-day the Company is under the direction of the Ministry of Defence, Government of India.

The Aircraft Design and Development Department is under the direction of Dr. V. M. Ghatage, M.Sc., D.Phil., A.F.R.Ae.S., as Chief Designer. A basic trainer called the Hindustan Trainer 2 (HT-2) has been designed and developed for the use of the Indian Air Force and for civilian basic training, and is now in full production.

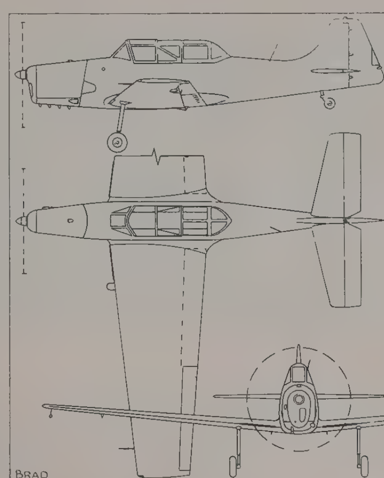
The design and development of a basic jet trainer and an advanced jet fighter trainer is progressing. The development of a medium transport aircraft is being considered.

The Company has also built a series of Prentice trainers under a licence agreement with Percival Aircraft Ltd., and is at present manufacturing the Vampire jet fighter under a licence from the de Havilland Aircraft Co., Ltd.

Among other activities of Hindustan Aircraft, Ltd. is the manufacture of steel railway coach bodies and light alloy omnibus bodies.



The Hindustan HT-2 Two-seat Primary Trainer (155 h.p. Cirrus Major III engine).



The Hindustan HT-2.

Two production Hindustan HT-2 Trainers for the Indian Air Force.

THE HINDUSTAN HT-2.

Type.—Two-seat Primary Trainer.

Wings.—Low-wing cantilever monoplane. Wing section NACA 23012. Aspect ratio 7.13. Dihedral 5.15 degrees. All-metal two-spar structure. All-metal split flaps. Area of ailerons (2) 14.35 sq. ft. (1.33 m.^{2}). Total flap area 14.18 sq. ft. (1.31 m.^{2}). Gross wing area 173.4 sq. ft. (16.0 m.^{2}).

Fuselage.—All-metal semi-monocoque structure.

Tail Unit.—Cantilever monoplane type. All-metal structure. Areas: fin 9.34 sq. ft. (0.86 m.^{2}), rudder 8.17 sq. ft. (0.75 m.^{2}), tailplane 16.8 sq. ft. (1.58 m.^{2}), elevators (2) 11.2 sq. ft. (1.05 m.^{2}).

Landing Gear.—Fixed tail-wheel type. Hindustan oleo-pneumatic shock-absorber struts. Dunlop wheels and hydraulic single-disc type brakes. Track: 9 ft. (2.74 m.).

Power Plant.—One 155 h.p. Cirrus Major III four-cylinder in-line inverted air-cooled engine driving a two-blade fixed-pitch wood airscrew. Two fuel tanks in wings. Total fuel capacity 26 Imp. gallons (117 litres).

Accommodation.—Enclosed tandem cockpits with dual controls. Separate sliding sections over each cockpit. Full standard basic training equipment, night and blind flying training equipment, etc.

Dimensions.—
- Span 35 ft. 2 in. (10.72 m.).
- Length 24 ft. 8.6 in. (7.53 m.).
- Height 8 ft. 11 in. (2.74 m.).

Weights.—
- Weight empty 1,540 lb. (702 kg.).
- Weight loaded 2,240 lb. (1,018 kg.).

Performance.—
- Max. speed 130 m.p.h. (209 km.h.).
- Cruising speed 115 m.p.h. (185 km.h.).
- Stalling speed without flaps 52 m.p.h. (84 km.h.).
- Initial rate of climb 800 ft./min. (244 m. min.).
- Service ceiling 14,500 ft. (4,420 m.).
- Absolute ceiling 16,500 ft. (5,060 m.).
- Still air range 350 miles (560 km.).
- Endurance at cruising speed 3.5 hours.

CHILE

FANAERO-CHILE

FÁBRICA NACIONAL DE AERONAVES (FANAERO-CHILE).

HEAD OFFICE: HUÉRFANOS 1202, PISO 4, SANTIAGO DE CHILE.

Administrative Council: General de Brigada Aérea (R) don Edison Díaz Salvo (President of the Council); Comandante de Grupo don Alberto Honnywell Mendiluce (Director of Fanaero-Chile); don Juan Fontecilla Astaburuaga (Fiscal representative); General de Brigada Aérea don Javier Undurraga Vergara (Director of Services, Chilean Air Force); Coronel don Rudi Geiger Stahr (Under-Secretary for Aviation); Coronel don Fernando Rojas Ortega (Director of Air Transport); don Harold Frey Weber (President of the National Council for External Trade); don Alejandro Ossa Puelma (Director General of the Chilean State Bank); and Ingeniero don Humberto Díaz Contreras (representing the Corporacion de Fomento de la Producción).

The Fabrica Nacional de Aeronaves (Fanaero-Chile) was created under the laws of the Republic in June, 1953, as a national but autonomously-administered enterprise to be responsible for the manufacture of all types of aircraft, aircraft parts and other aeronautical equipment. It is also empowered to manufacture and market machinery, tools and other industrial equipment.

Fanaero-Chile has its headquarters in Santiago and will have its production facilities at Rancagua, Province of O'Higgins. Pending the construction of the necessary plant and hangars, which is being undertaken by the Corporacion de Formento de la Produccion, Fanaero-Chile is temporarily using the facilities of the Maestranza Central de Aviacion (see below).

Fanaero-Chile is engaged in the design and construction of a prototype of a 145 h.p. two-seat military primary trainer.

CENTRAL WORKSHOPS

MAESTRANZA CENTRAL DE AVIACION.

"EL BOSQUE" AIR BASE, SANTIAGO.

Commandant: Colonel (R.I.) Pedro Loyer.

The Maestranza Central, or Central Workshops of the Chilean Air Force, designs and builds aeroplanes with the object of giving both theoretical and practical experience to the new generation of aeronautical engineers who receive their diplomas in the Air Force Engineering College at "El Bosque."

The first aeroplane of Chilean conception, the Triciclo-Experimental was built by the Maestranza Central de Aviacion. Designed by Senor Alfredo Davins Ferrer, it was built by Chileans of Chilean materials, the only imported component being the 100 h.p. Franklin engine with which it is powered. This aeroplane was first demonstrated in public at a national ceremony, at which the President of the Republic, members of the Government and Air Force Chiefs were present, at the "El Bosque" Airport, Santiago, in May, 1947. The Triciclo-Experimental has been described and illustrated in previous editions of this Annual.

The establishment has now built the XX-02, a two-seat side-by-side training monoplane which has been designed by Capt. de Bandada Hugo Fuentes, an aeronautical engineer who received his training in Europe.

Two new designs are being developed but they are not expected to fly before 1956.

The H.F. XX-02 Two-seat Trainer (175 h.p. Ranger L-440 engine).

THE H.F. XX-02.

TYPE.—Two-seat Trainer.

WINGS.—Low-wing cantilever monoplane. NACA 23012 wing section. Aspect ratio 7.13. Mean chord 1.62 m. (5 ft. 4 in.). Dihedral 5°. Incidence 3°. Plywood-covered wood structure using national timbers. Both flaps and ailerons have wood frames and fabric covering. Total flap area 1.0 m.^{2} (10.76 sq. ft.), total aileron area 1.2 m.^{2} (12.91 sq. ft.). Gross wing area 16.96 m.^{2} (182.5 sq. ft.).

FUSELAGE.—Welded steel-tube structure covered with fabric.

TAIL UNIT.—Cantilever monoplane type. All-wood structure. Tailplane span 3.24 m. (10 ft. 7 in.). Areas: fin 0.62 m.^{2} (6.67 sq. ft.), rudder 0.90 m.^{2} (9.68 sq. ft.), tailplane 1.19 m.^{2} (12.80 sq. ft.), elevators (total) 0.98 m.^{2} (10.54 sq. ft.).

LANDING GEAR.—Fixed tail-wheel type. Bendix hydraulic shock-absorber struts. Goodyear expander tube type brakes. Wheel track 2.20 m. (7 ft. 2½ in.).

POWER PLANT.—One 175 h.p. Ranger L-440-1 four-cylinder in-line inverted air-cooled engine. Two-blade National wood airscrew. Two fuel tanks, one in each wing root, with total capacity of 140 litres (31 Imp. gallons).

ACCOMMODATION.—Crew of two side-by-side with dual controls.

DIMENSIONS.—
- Span 11.0 m. (36 ft. 1 in.).
- Length 6.42 m. (21 ft. 0 in.).
- Height 2.14 m. (7 ft.).
- Wing area 16.96 m.^{2} (182.4 sq. ft.).

WEIGHT AND LOADING (Designed).
- Weight loaded 900 kg. (1,980 lb.).
- Wing loading 59 kg./m.^{2} (22.33 lb./sq. ft.).

PERFORMANCE (Estimated).—
- Max. speed 230 km.h. (143 m.p.h.).
- Landing speed 70 km.h. (43.5 m.p.h.).
- Max. diving speed 353 km.h. (219 m.p.h.).

The H.F. XX-02 Two-seat Trainer (175 h.p. Ranger L-440 engine).

CZECHOSLOVAKIA

CESKOSLOVENSKÉ ZÁVODY AUTOMOBILOVÉ A LETECKÉ (Czechoslovak Automobile and Aircraft Works).

Head Office: Krizíkova 38, Prague X.

General Manager: F. Horák.

In this concern are grouped all the factories engaged in the production of aircraft, aero-engines, airscrews, aviation instruments and equipment, etc.

The sale of all the aviation products as well as the information service are handled exclusively by:

MOTOKOV LIMITED (Vehicle and Light Engineering Import and Export Company).

Aviation Sales Department, Tř. Dukelskych Hrdinů 47, Prague VII.

The Zlin 126 Trener Mk. 2 (105 h.p. Walter Minor 4-III engine).

THE ZLIN 126 TRENER Mk. 2.

The Trener Mk. 2 has been developed from the Zlin 26 Trener all-wood basic trainer which has been used for elementary and aerobatic training since 1947. Both the first prototype and first production Trener Mk. 2 flew in 1953.

Type.—Two-seat basic Trainer. Fully aerobatic at normal A.U.W. Fitted for glider-towing.

Wings.—Low-wing cantilever monoplane. All-metal two-spar structure with flush-riveted light alloy stressed skin. Electrically-actuated flaps inboard of ailerons. Gross wing area 14.9 m.² (160.38 sq. ft.).

Fuselage.—Welded steel tube structure, upper and lower surfaces covered with easily-removable metal panels and remainder with fabric.

Tail Unit.—Cantilever monoplane type. Removable tailplane and fin of metal stressed-skin construction. Elevator and rudder have metal frames and fabric covering. Controllable trim-tab in elevator. Areas: tailplane 2.316 m.² (24.92 sq. ft.), fin 1.320 m.² (14.20 sq. ft.).

Landing Gear.—Fixed tail-wheel type. Cantilever oleo-pneumatic shock struts attached to front steel centre-section spar which is welded to fuselage. Single-disc mechanical brakes actuated from both cockpits. Fully-castoring self-centering tail-wheel, steerable to 30° either side of centre-line.

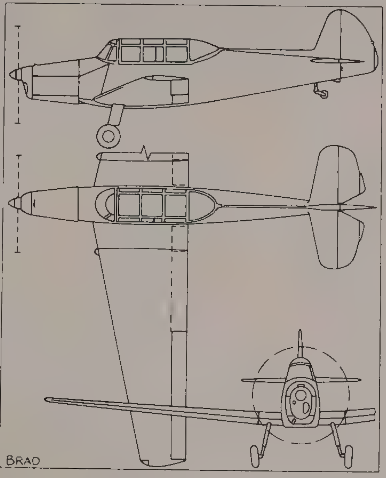
Power Plant.—One 105 h.p. Walter Minor 4-III four-cylinder in-line inverted air-cooled engine. Fixed-pitch wooden airscrew 2 m. (6 ft. 6½ in.) diameter. One fuel tank (35 litres = 7.7 Imp. gallons) in each wing root. Gravity tank (7 litres = 1.5 Imp. gallons) interconnected with main tanks and is replenished automatically in flight. Fuel and oil installation designed for aerobatics and permits inverted flying for 4 minutes.

Accommodation.—Tandem seats under continuous sliding canopy which is jettisonable in an emergency. Windscreen frame reinforced as crash pylon. Complete dual controls and instrumentation. Full standard blind-flying panels. Radio and intercomm. Adjustable seats and rudder pedals in both cockpits. Seat cushions may be replaced by seat type parachutes.

Dimensions.—
Span 10.28 m. (33 ft. 9 in.).
Length 7.49 m. (24 ft. 7 in.).
Height 2.06 m. (6 ft. 9 in.).

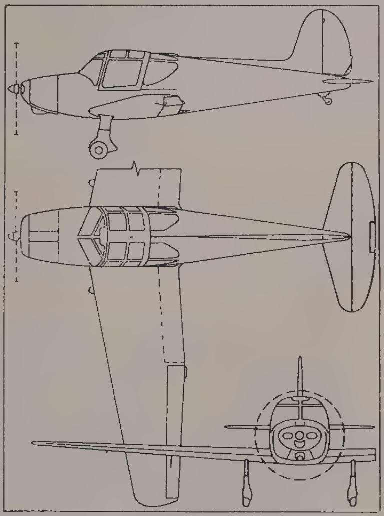
Weights.—
Weight empty 505 kg. (1,113 lb.).
Disposable load 255 kg. (562 lb.).
Weight loaded 760 kg. (1,675 lb.).

Performance.—
Max. speed at S/L. 205 km.h. (127 m.p.h.).
Cruising speed (70% rated power) 180 km.h. (102 m.p.h.).



The Zlin 126 Trener Mk. 2.

Landing speed 74 km.h. (46 m.p.h.).
Max. permissible diving speed 320 km.h. (200 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 5 min. 10 sec.
Climb to 2,000 m. (6,560 ft.) 12 min. 15 sec.
Climb to 3,000 m. (9,840 ft.) 22 min. 40 sec.
Climb to 4,000 m. (13,120 ft.) 34 min. 30 sec.
Service ceiling 4,500 m. (14,760 ft.).
Cruising range 600 km. (373 miles).
Endurance 3.5 hours.
Take-off run 170 m. (186 yds.).
Landing run 150 m. (164 yds.).



The Zlin 22 Light Monoplane.

THE ZLIN 22.

Type.—Two-seat or three-seat Training and Touring monoplane.

Wings.—Cantilever low-wing monoplane. Wooden two-spar structure. Centre-section entirely plywood-covered. Outer wings have forward portions covered with plywood and the remainder with fabric. Split flaps extend from aileron to aileron beneath fuselage and all sections interconnected. Mechanical operation. Max. flap depression 60°. Wing area 14.65 m.² (157.7 sq. ft.).

Fuselage.—Wooden monocoque structure.

Tail Unit.—Cantilever monoplane type. Wooden structure with ply-covered fin and tailplane and fabric covering to rudder and one-piece elevator. Controllable trim-tab in elevator.

Landing Gear.—Fixed tail-wheel type. Oleo-pneumatic cantilever shock-absorber struts. Differential mechanically-operated wheel-brakes. Fully-castoring and steerable oleo-sprung tail-wheel. Wheel track 2.08 m. (6 ft. 9½ in.). Wheels can be replaced by skis.

Power Plant.—One 75 h.p. Praga D four-cylinder horizontally-opposed, air-cooled engine driving two-blade fixed-pitch wooden airscrew. Normal fuel capacity is 72 litres (15.8 Imp. gallons) in main tank in port centre-section and gravity tank in fuselage. For long-range a second main tank, capacity 65 litres (14.3 Imp. galls.), may be installed in star-board centre-section. This second main tank is fitted for two-seater version only.

Accommodation.—Enclosed cabin with accommodation for pilot and passenger side-by-side. Optional, a third seat can be fitted behind the front seats (for version with 650 km. (400 mile) range only). Dual controls with starboard column removable. Sliding canopy. Luggage compartment aft of seats. Optional equipment: cabin heating, electric equipment, radio, blind flying instruments.

Dimensions.—
Span 10.60 m. (34 ft. 9 in.).
Length 7.25 m. (23 ft. 9½ in.).
Height 1.96 m. (6 ft. 5 in.).

Weights and Loadings (two-seat trainer).—
Weight empty 365 kg. (804 lb.).
Crew (2) 155 kg. (342 lb.).
Fuel and oil 60 kg. (132 lb.).
Weight loaded 580 kg. (1,278 lb.).
Wing loading 39.5 kg./m.² (8.1 lb./sq. ft.).
Power loading 7.7 kg./h.p. (17.0 lb./h.p.).

Weights and Loadings (two-seat tourer).—
Weight empty 370 kg. (816 lb.).
Crew (2) 155 kg. (342 lb.).
Fuel and oil 105 kg. (231 lb.).
Luggage 20 kg. (44 lb.).
Weight loaded 650 kg. (1,433 lb.).
Wing loading 44.3 kg./m.² (9.0 lb./sq. ft.).
Power loading 8.6 kg./h.p. (19.1 lb./h.p).

Weights and Loadings (three-seat tourer).—
Weight empty 365 kg. (804 lb.).
Crew (3) 232 kg. (510 lb.).
Fuel and oil 60 kg. (132 lb.).
Weight loaded 660 kg. (1,456 lb.).
Wing loading 45.3 kg./m.² (9.2 lb./sq. ft.).
Power loading 8.8 kg./h.p. (19.4 lb./h.p.).

Performance (two-seat trainer).—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Landing speed with flaps 55 km.h. (34 m.p.h.).

The Zlin 22 Cabin Monoplane (75 h.p. Praga D engine).

Initial rate of climb 180 m./min. (590 ft./min.).
Service ceiling 4,500 m. (14,700 ft.).
Cruising range 650 km. (400 miles).
Take-off run with flaps 120 m. (130 yds.).
Landing run with flaps and brakes 100 m. (110 yds.).

PERFORMANCE (two-seat tourer).—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Landing speed 65 km.h. (40 m.p.h.).
Initial rate of climb 140 m./min. (460 ft./min.).
Service ceiling 3,800 m. (12,400 ft.).
Cruising range 1,200 km. (740 miles).
Take-off run with flaps 150 m. (165 yds.).
Landing run with flaps and brakes 130 m. (140 yds.).

PERFORMANCE (three-seat tourer).—
The same as for the two-seat plane, except the cruising range 650 km. (400 miles).
Fuel consumption at cruising speed 17.3 litres/hour (3.8 Imp. galls./hour).

THE SUPER AERO 45.

TYPE.—Twin-engined Sports aircraft, Trainer, Tourer, Business Transport plane, Air-taxi or small Feeder-liner.

WINGS.—Cantilever low-wing monoplane. All-metal two-spar structure. I-section spars, duralumin ribs and sheet duralumin covering. Statically and dynamically-balanced ailerons have metal frames and fabric covering. Leading-edge slots between fuselage and engine nacelles. Electrically-operated two-position split trailing-edge flaps, in two sections each side. Wing area 17.1 m.² (184 sq. ft.).

FUSELAGE.—Metal monocoque structure. Nose section hinged for access to controls and battery.

TAIL UNIT.—All-metal cantilever monoplane type. Fin integral with fuselage. Fixed surfaces metal-covered. Statically and dynamically-balanced rudder and elevators have metal frames and fabric covering. Controllable trim-tabs in rudder and elevators.

LANDING GEAR.—Retractable two-wheel type. Oleo-pneumatic shock-absorber legs. Electrical operation, with emergency mechanical gear. Low-pressure tyres, and hydraulically-operated brakes. Track 2.93 m. (9 ft. 7 in.). Castoring oleo-sprung tail-wheel, with centre-lock and with earth cable. Wheels can be replaced by skis or floats.

The Aero 45 (two 105 h.p. Walter Minor 4-III engines).

POWER PLANT.—Two 105 h.p. Walter Minor 4-III four-cylinder in-line air-cooled engines flexibly mounted on light metal bearers. Two-blade variable-pitch airscrews. Fuel capacity 324 litres (71 Imp. gallons) in four inter-spar light alloy tanks. Aluminium oil-tank behind each engine. Electric starters.

ACCOMMODATION.—Enclosed cabin seating pilot (on port) and one passenger side-by-side with single or dual controls, and two or three passengers behind on full-width seat. Access door on port side hinges upwards. Front seats adjustable. Cabin heat and sound proofed and ventilated; if desired, also heated. Large luggage compartment behind rear seats. Flight and blind flying instruments. Complete electric equipment. Radio, if desired.

DIMENSIONS.—
Span 12.3 m. (40 ft. 4 in.).
Length 7.54 m. (24 ft. 9 in.).
Height 2.30 m. (7 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 860 kg. (1,896 lb.).
Crew 308 kg. (680 lb.).
Fuel 227 kg. (500 lb.).
Oil 15 kg. (33 lb.).
Luggage 90 kg. (197 lb.).
Weight loaded 1,500 kg. (3,306 lb.).
Wing loading 87.8 kg./m². (18.0 lb./sq. ft.).
Power loading 7.1 kg./h.p. (15.7 lb./h.p.).

PERFORMANCE.—
Max. speed 285 km.h. (177 m.p.h.)
Cruising speed (75% power) 245 km.h. (152 m.p.h.).
Landing speed 80 km.h. (50 m.p.h.).
Initial rate of climb 300 m./min. (980 ft./min.).
Service ceiling 5,700 m. (18,700 ft.).
Service ceiling on one engine 1,500 m. (4,900 ft.).
Absolute ceiling 6,400 m. (21,000 ft.).
Take-off run (with flaps) to clear 50 ft. (15.25 m.) 350 m. (383 yds.).
Landing run, with flaps and brakes 190 m. (208 yds.).
Range 1,500 km. (930 miles).
Fuel consumption at cruising speed 50 litres/hour (11 Imp. gallons/hour).

DENMARK

KZ

SKANDINAVISK AERO INDUSTRI A/S.

REGISTERED OFFICE: 1 JENS KOFODS GADE, COPENHAGEN K.

WORKS: AIRPORT OF COPENHAGEN, KASTRUP.

Directors: Morgens Harttung, V. Kramme and K. G. Zeuthen

Skandinavisk Aero Industri A/S was founded in 1937 to manufacture light aircraft. The company was financed by a large Danish industrial concern and took over the aircraft manufacturing business formerly conducted by Messrs. Kramme & Zeuthen, who had previously built the KZ I light single-seat monoplane.

Since its formation the company has built the KZ II two-seat primary trainer, a small series of which was supplied to the Danish Air Force; the KZ III two-seat and the KZ VII Lark four-seat cabin monoplanes, both of which have been built for domestic, European and overseas markets, and the KZ VIII single-seat aerobatic monoplane.

Due to increasing difficulties in marketing civil types abroad under the currency restrictions which exist in most countries at the present time, the company has recently slowed down civil production and is concentrating on military training aircraft and repair and maintenance work.

The company's latest product is the KZ X A.O.P. monoplane, which is a modification of the KZ VII to meet the requirements for an artillery observation aircraft. Twelve have been ordered by the Danish Army.

The KZ X Light Observation Monoplane (145 h.p. Continental C145 engine).

THE KZ X.

TYPE.—Two-seat Light Observation monoplane.

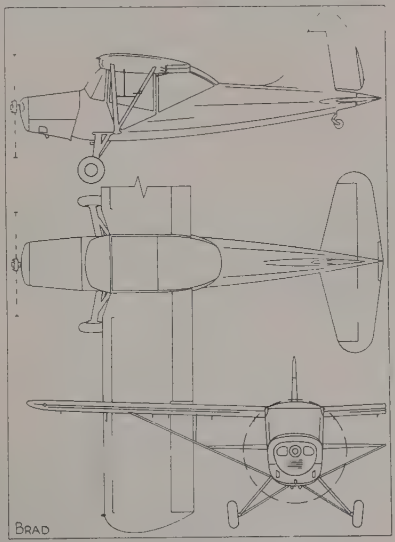
WINGS.—High-wing strut-braced monoplane. Structure consists of spruce box spars, wooden ribs and plywood covering. Full span leading-edge slots. Slotted flaps and ailerons.

FUSELAGE.—Welded steel-tube structure faired with wooden stringers, the whole being fabric-covered.

TAIL UNIT.—Cantilever monoplane type. All-wood adjustable tailplane. Fin integral with fuselage. Rudder and elevator of fabric-covered steel-tube construction.

LANDING GEAR.—Fixed split-axle type. Coil springs with friction dampening as the shock absorbing medium. Full castoring and steerable tail-wheel.

POWER PLANT.—One 145 h.p. Continental C145-2 six-cylinder horizontally-opposed air-cooled engine driving an Aeromatic two-blade controllable-pitch airscrew. Starter and generator as standard. Fuel capacity 150 litres (40 Imp. gallons).



The KZ X A.O.P. monoplane

ACCOMMODATION.—Enclosed cabin seating two in tandem. The rear seat for the observer is on a swivel base. For emergency exit the door (port side) and the rear top Perspex panel are jettisonable.

DIMENSIONS.—
Span 9.4 m. (30 ft. 10 in.).
Length 6.5 m. (21 ft. 4 in.).
Height (tail down) 2.1 m. (6 ft. 11 in.).

WEIGHTS.—
Weight empty 500 kg. (1,100 lb.).
Fuel and oil 115 kg. (255 lb.).
Pilot and observer 180 kg. (400 lb.).
Equipment (radio, etc.) 65 kg. (144 lb.).
Weight fully loaded 860 kg. (1,900 lb.).

PERFORMANCE.—
Max. speed 215 km.h. (134 m.p.h.).
Cruising (max.) 193 km.h. (120 m.p.h.).
Min. speed 45-50 km.h. (under 30 m.p.h.).
Take-off run 125 m. (410 ft.).
Landing run 50 m. (165 ft.).

THE KZ VII LARK.

TYPE.—Four-seat cabin monoplane.

WINGS.—Braced high-wing monoplane. Aerofoil section NACA 12023. Wooden structure in two main sections attached to top longerons and braced to lower longerons by steel-tube V-struts on each side. Structure consists of two spruce spars and spruce ribs with ply-covered leading-edge and fabric covering aft. Dihedral 2 degrees. Wing area 13 m.² (140 sq. ft.). Slotted ailerons arranged to droop when flaps are lowered. Manually-operated slotted flaps. Built-in fixed slot ahead of front spar running almost complete span.

FUSELAGE.—Welded steel-tube structure with fabric covering.

TAIL UNIT.—Wooden cantilever fin with fabric covering. Horn-balanced and mass-balanced rudder of steel-tube construction with fabric covering. Trim-tab adjustable on ground only. Wooden cantilever tailplane with plywood covering. One-piece elevator has same structure as rudder. Adjustable tailplane with elevator trim-tab automatically connected with tailplane movement.

LANDING GEAR.—Fixed divided type. Consists of two steel-spring shock-absorber legs each braced by V-struts to fuselage centre-line. Low-pressure wheels fitted with 6.00 × 6½ tyres and brakes. Track 2.4 m. (7 ft. 10½ in.). Steerable tail-wheel on helical-spring shock-absorber.

POWER PLANT.—One 125 h.p. Continental C125 six-cylinder horizontally-opposed air-cooled engine on welded steel-tube mounting and driving two-blade fixed-pitch wooden airscrew 1.9 m. (6 ft. 4 in.) diameter. Fuel tanks (two) of 110 litres (24 Imp. gallons) total capacity in wings. Oil capacity 8.2 litres (8.2 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating four in two pairs. Interior width 1.22 m. (4 ft. 0 in.). Dual controls with central Y-type control column. Rear seats easily removable to enable the aircraft to be used for various purposes, including training, charter and taxi operations, freight-carrying, etc.

DIMENSIONS.—
Span 9.60 m. (31 ft. 6 in.).
Length 6.56 m. (21 ft. 6 in.).
Height 2.10 m. (6 ft. 11 in.).
Wing area 13 m.² (140 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight empty 464 kg. (1,022 lb.).
Fuel and oil 89 kg. (196 lb.).
Disposable load 314 kg. (693 lb.).
Weight loaded 867 kg. (1,911 lb.).
Wing loading 66.6 kg./m.² (13.5 lb./sq. ft.).
Power loading 6.9 kg./h.p. (15.3 lb./h.p.).

PERFORMANCE.—
Max. speed 200 km. (125 m.p.h.) at sea level.
Cruising speed 185 km.h. (115 m.p.h.).
Landing speed 64 km.h. (40 m.p.h.).
Initial rate of climb 170 m./min. (590 ft./min.).
Service ceiling 4,115 m. (13,500 ft.).
Range 725 km. (450 miles).

The KZ VII Lark Cabin Monoplane (125 h.p. Continental C125 engine).

FINLAND

EKLUND

TOROLF EKLUND.

HALLI, FINLAND.

Mr. T. Eklund, a Finnish aeronautical engineer, has designed in his spare time a small single-seat amphibian flying-boat which has been built in one of the State Metal Factories.

THE EKLUND TE-1B.

The prototype TE-1 made its first flight on February 24, 1949, powered by a 25-28 h.p. Poinsard flat-twin engine. Because of crankcase failure and the impossibility of getting spares for this obsolete French engine, the prototype TE-1 was later fitted with a 40 h.p. Continental A40 engine.

The latest version is the TE-1B which is described below.

TYPE.—Light Single-seat Cabin monoplane.

WINGS.—High-wing braced monoplane. NACA 63.3-618 wing section. Aspect ratio 12. Incidence 5 constant. Dihedral 2°. Single-spar structure covered with plywood. Wings braced to hull by single steel-tube strut on each side. Frise type ailerons covered with plywood. Adjustable trim-tab in right aileron. Total aileron area 0.47 m.^{2} (5 sq. ft.). Wing area 4.7 m.^{2} (50 sq. ft.).

HULL.—Single-step type. Plywood covered all-wood structure divided into five water-tight compartments. Bottom reinforced for landing on snow. Wing-tip floats of same structure as hull. Retractable water-rudder under tail.

TAIL UNIT.—Fin integral with hull. One-piece tailplane attached to top of fin by three bolts. Wood frames with plywood covering. Adjustable tabs on elevator and rudder. Areas: fin 0.33 m.^{2} (3.5 sq. ft.), rudder 0.33 m.^{2} (3.5 sq. ft.), tailplane 0.47 m.^{2} (5 sq. ft.), elevators 0.47 m.^{2} (5 sq. ft.). Tailplane span 1.25 m. (4 ft. 1 in.).

The prototype Eklund TE-I (40 h.p. Continental A40 engine).

POWER PLANT.—One 65 h.p. Walter Mikron III four-cylinder in-line inverted air-cooled engine in welded steel-tube nacelle attached to wing centre-section at three points. Fuel tank (50 litres = 13 U.S. gallons) in rear portion of nacelle behind fireproof bulkhead. Wood fixed-pitch airscrew.

ACCOMMODATION.—One seat in enclosed crash-resistant cabin below wing. Seat built into aircraft's structure. Door in roof. Sides and front of cabin glazed with Plexiglas panels. Control by column and foot-pedals. Luggage compartment behind pilot.

DIMENSIONS.—
- Span 7.5 m. (24 ft. 7 in.).
- Width folded 1.25 m. (4 ft. 1 in.).
- Length 5.4 m. (17 ft. 8 in.).
- Height 1.8 m. (5 ft. 11 in.).

WEIGHTS AND LOADINGS.—
- Weight empty 190 kg. (420 lb.).
- Fuel (3 hours cruise) 35 kg. (77 lb.).
- Oil 6 kg. (13 lb.).
- Pilot 77 kg. (170 lb.).
- Baggage 7 kg. (15 lb.).
- Weight loaded 315 kg. (695 lb.).
- Wing loading 6.7 kg./m.^{2} (13.9 lb./sq. ft.).
- Power loading 4.85 kg./h.p. (10.7 lb./h.p.).

PERFORMANCE.—
- Max. speed 205 km.h. (128 m.p.h.).
- Cruising speed 180 km.h. (112 m.p.h.).
- Alighting speed 93 km.h. (58 m.p.h.).

HEINONEN

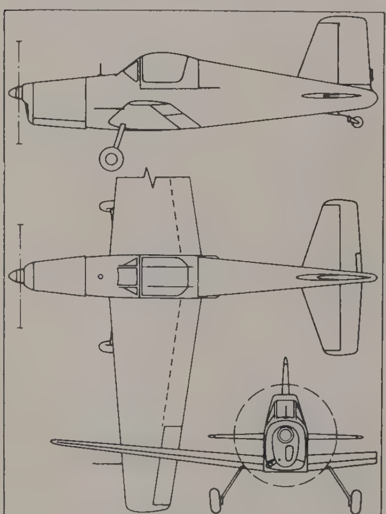
JUHANI HEINONEN.

ADDRESS: HELSINKI AIRPORT, HELSINKI.

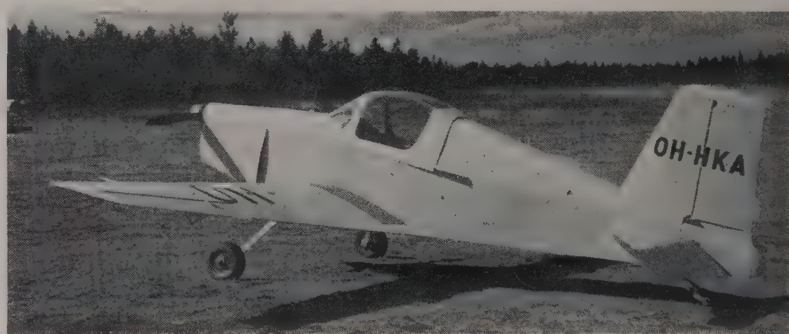
Mr. J. Heinonen, a Finnish aeronautical engineer, former designer at the Valmet Oy Aircraft Factory in Tampere and now employed by the Finnish Airlines (Aero Oy), has in his spare time designed and built, at the Jämi Soaring School, a small single-seat monoplane, the HK-1. The prototype made its first flight in August, 1954.

THE HEINONEN HK-1.

TYPE.—Single-seat Sports and Aerobatic monoplane.



The Heinonen HK-I.



The Heinonen HK-I (65 h.p. Walter Mikron III engine).

WINGS.—Low-wing cantilever monoplane. Wing section NACA 643A418 (root), NACA 631A412 (tip). Aspect ratio 6.8. Root chord 1.34 m. (4 ft. 5 in.), tip chord 0.615 m. (2 ft.). Dihedral 5°. Incidence (at root) 3°. One piece all-wood wing attached to the fuselage by four bolts. One main spar of I-section. Slotted ailerons are fabric covered. Split flaps are of Alclad sheet and have a duralumin torsion tube. Total flaps area 0.94 m.^{2} (10.1 sq. ft.). Total area of aileron 0.69 m.^{2} (7.4 sq. ft.). Gross wing area 7 m.^{2} (75 sq. ft.).

FUSELAGE.—Plywood covered all-wood structure with four longerons. The frames have straight sides. The fin is integral with the fuselage.

TAIL UNIT.—Cantilever all-wood structure. The rudder and elevator are fabric covered. Adjustable trim tab in the elevator.

LANDING GEAR.—Fixed tail-wheel type. Cantilever spring steel main legs are attached to the wing. Steerable tail wheel. Track 2 m. (6 ft. 6 in.).

POWER PLANT.—One 65 h.p. Walter Mikron III four-cylinder in-line inverted air-cooled, or any equivalent engine. Two-blade wooden airscrew 1.53 m. (5 ft.) in diameter. Fuel capacity 58 litres (13 Imp. gallons).

ACCOMMODATION.—Rearward sliding canopy is made of Perspex. Luggage compartment 0.14 m.^{3} (5 cub. ft.) is behind the seat. The crash pylon is made of steel tube.

DIMENSIONS.—
- Span 6.9 m. (22 ft. 6 in.).
- Length 5.35 m. (17 ft. 6 in.).
- Height (from airscrew tip) 2.1 m. (6 ft. 10 in.).

WEIGHTS AND LOADINGS.—
- Weight empty 250 kg. (550 lb.).
- Weight loaded (aerobatic category) 360 kg. (795 lb.).
- Weight loaded (normal category) 400 kg. (880 lb.).
- Wing loading (aerobatic category) 51.4 kg./m.^{2} (10.5 lb./sq. ft.).
- Power loading (aerobatic category) 5.53 kg./h.p. (12.2 lb./h.p.).

PERFORMANCE.—
- Max. speed at S/L. 215 km.h. (135 m.p.h.)
- Cruising speed at S/L. 185 km.h. (115 m.p.h.).
- Landing speed 75 km.h. (47 m.p.h.).
- Max. range 700 km. (430 miles).

KARHUMÄKI

VELJEKSET KARHUMÄKI O/Y.

HEAD OFFICE AND WORKS: HALLI.

Managing Director: Niilo Karhumäki.

Technical Director: Olavi Raunio.

Veljekset Karhumäki O/Y was founded in 1924. The present factory was built in 1939-41 near the airfield of Halli.

At present the company is building training aircraft for the Finnish Air Force and the Karhu-48B monoplane described below.

THE KARHU 48B.

TYPE.—Four-seat Cabin monoplane.

WINGS.—High-wing rigidly braced monoplane. Wing braced by steel-tube vee struts. Two-spar wooden structure covered with fabric. Flaps and ailerons have welded steel-tube frames and fabric covering. Wing area 17.31 m.^{2} (186.25 sq. ft.).

FUSELAGE.—Welded steel-tube structure covered with fabric.

TAIL UNIT.—Braced monoplane type. Welded steel-tube framework covered with fabric.

Landing Gear.—Tail-wheel type with interchangeable wheels and skis. Faired side vees, incorporating springing, and two half axles hinged at centre-line of underside of fuselage. Steerable tail-wheel. Landing-gear may be replaced by twin all-metal siingle-step float of Karhumäki design and construction. Water-rudder on port float.

Power Plant.—One 190 h.p. Lycoming O-435A six-cylinder horizontally-opposed air-cooled engine driving an Aeromatic 220 variable-pitch airscrew.

Accommodation.—Enclosed cabin seating four, two single-seats in front with removable dual controls and a full-width seat aft. Entrance door on each side. Two baggage compartments. Cabin heating and ventilation. Radio fitted as standard.

Dimensions.—
Span 11.54 m. (37 ft. 10 in.).
Length (landplane) 7.85 m. (25 ft. 9 in.).
Length (seaplane) 8.10 m. (26 ft. 6½ in.)

Weights and Loadings (Landplane).—
Weight empty 813 kg. (1,789 lb.).
Weight loaded 1,310 kg. (2,882 lb.).
Wing loading 75.7 kg./m.² (15.52 lb./sq. ft.).
Power loading 6.9 kg./h.p. (15.18 lb./h.p.).

Weights and Loadings (Seaplane).—
Weight empty 905 kg. (1,991 lb.).
Weight loaded 1,400 kg. (3,080 lb.).
Wing loading 81 kg./m.² (16.60 lb./sq. ft.).
Power loading 7.4 kg./h.p. (16.28 lb./h.p.).

Performance (Landplane).—
Max. speed 229 km.h. (142.2 m.p.h.).
Cruising speed 186 km.h. (115.5 m.p.h.)
Landing speed 78 km.h. (48.4 m.p.h.).
Service ceiling 4,800 m. (15,745 ft.).
Cruising range 700 km. (435 miles).

Performance (Seaplane).—
Max. speed 203 km.h. (126 m.p.h.).
Cruising speed 176 km.h. (109.3 m.p.h.)
Alighting speed 83 km.h. (51.5 m.p.h.).
Service ceiling 4,200 m. (13,780 ft.).
Cruising range 650 km. (404 miles).

The Karhu 48B Cabin Monoplane (190 h.p. Lycoming O-435A engine).

PIK

THE FLYING CLUB OF THE FINNISH INSTITUTE OF TECHNOLOGY (POLYTEKNIKKOJEN ILMAILUKERHO).

Address : Lönnrotinkatu 29, Helsinki.

This club was established in 1931 and has since been engaged mainly in gliding activities. Of the series of gliders designed and constructed, the primary glider PIK-7, the intermediate types PIK-5a, b, and c and the advanced sailplanes PIK-3a and b are of particular interest due to the fact that they have been accepted as standard types for Finnish Gliding Clubs. A high-performance sailplane, the PIK-13, was constructed for the 1954 World Championships. The prototype made its maiden flight in June, 1954. The first powered aeroplane to be built in the club was the PIK-11, which flew in March, 1953.

The PIK-11 (65 h.p. Continental A65-8 engine).

THE PIK-11.

Type.—Single-seat Light Sports monoplane.

Wings.—Low-wing cantilever monoplane. Wing section NACA 2415/4409R. Aspect ratio 7.1. Root chord 1.5 m. (4 ft. 11 in.), tip chord 0.75 m. (2 ft. 5½ in.). Dihedral 6°. One piece single box-spar with plywood covered leading edge D-section. Fabric covering aft of spar. Auxiliary spar carries slotted fabric covered ailerons. No flaps. Gross wing area 9.0 m.² (97 sq. ft.).

Fuselage. — All - wood semi - monocoque structure.

Tail Unit.—One-piece cantilever tailplane with plywood skin. Fin integral with fuselage. Movable surfaces fabric covered. Controllable trim tab in elevator. Horizontal tail area 1.56 m.² (16.8 sq. ft.), span 2.35 m. (7 ft. 8½ in.).

Landing Gear.—Spring steel type. No brakes. Steerable tail-wheel.

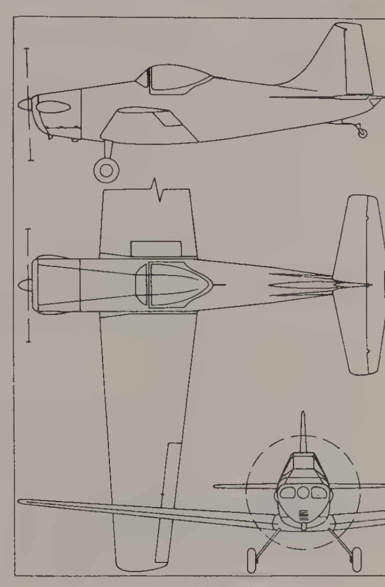
Power Plant.—One 65 h.p. Continental A65-8 four-cylinder horizontally-opposed air-cooled engine, driving a two-blade fixed-pitch wood airscrew. Airscrew diameter 1.6 m. (5 ft. 3 in.). Fuel tank (capacity 65 litres = 14.3 Imp. gallons) in fuselage behind the firewall.

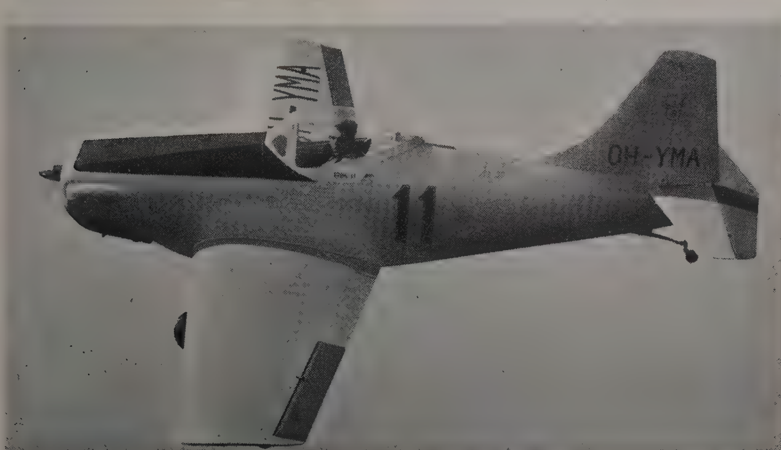
Accommodation.—Single-seat cockpit with jettisonable Perspex canopy.

Dimensions.—
Span 8.0 m. (26 ft. 3 in.).
Length 5.5 m. (18 ft.).
Height 1.65 m. (5 ft. 5 in.).

Weights and Loadings.—
Weight empty 238 kg. (525 lb.).
Weight loaded 373 kg. (825 lb.).
Wing loading 41 kg./m.² (8.5 lb./sq. in.).
Power loading 5.65 kg./h.p. (12.7 lb./h.p.).

Performance.—
Max. speed at S/L. 220 km.h. (137 m.p.h.).
Cruising speed at S/L. 170 km.h. (106 m.p.h.).
Landing speed 80 km.h. (50 m.p.h.).
Initial rate of climb 330 m./min. (1,080 ft./min.).
Climb to 1,000 m. (3,300 ft.) 3 min. 10 sec.
Climb to 5,000 m. (16,500 ft.) 31 min.
Range 700 km. (430 miles).
Take-off run to clear 50 ft. (no wind) 300 m. (985 ft.).


The PIK-11.



The PIK-11 Light Single-seat Monoplane (65 h.p. Continental A65-8 engine).

THE PIK-13.

Type.—Single-seat High-performance Sailplane. Ultimate load factor 8.

Wings.—Shoulder-wing cantilever monoplane. Wing section Göttingen 549 at root, tapering to Göttingen 693 at tip. Aspect ratio 21. Dihedral 3°. Root chord 1.26 m. (4 ft. 1½ in.), tip chord 0.42 m. (1 ft. 4½ in.). Single spruce and plywood spar with D-nose of plywood. Plywood covering to 60% of wing chord. Slotted ailerons, with 50° movement. Dive brakes on upper surfaces. Gross wing area 14.6 m.² (158 sq. ft.).

Fuselage.—Wood structure with plywood skin.

Tail Unit.—Cantilever monoplane type.

All-wood frames with fixed surfaces plywood-covered and movable surfaces fabric-covered. Total area of horizontal surfaces 1.7 m.^{2} (18.3 sq. ft.) of vertical surfaces 1.15 m.^{2} (12.4 sq. ft.).

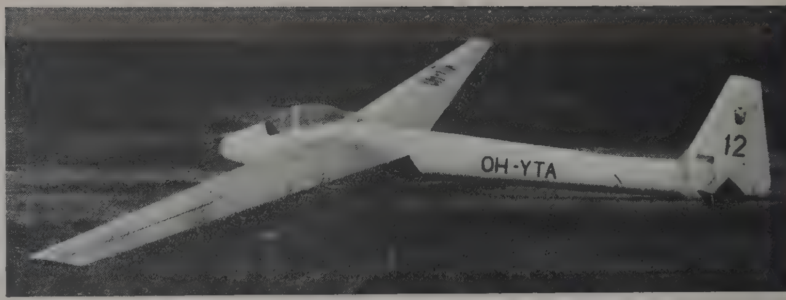
Landing Gear.—Wood skid, rubber sprung, and single-wheel half buried in fuselage. Small tail-skid.

Accommodation.—Single enclosed cockpit.

Dimensions.—Span 17.6 m. (58 ft.).
Length 7.3 m. (24 ft.).
Height 1.55 m. (5 ft. 1 in.).

Weights and Loadings.—
Weight empty 197 kg. (435 lb.).
Weight loaded 300 kg. (665 lb.).
Wing loading 20.5 kg./m.^{2} (4.2 lb./sq. in.).

Performance.—
Designed max. speed 250 km.h. (155 m.p.h.).
Best gliding ratio 33 : 1 at 85 km.h. (53 m.p.h.).
Min. sinking speed 0.70 m./sec. (2.3 ft./sec.) at 62 km.h. (38 m.p.h.).
Auto towing speed (max.) 115 km.h. (72 m.p.h.).
Aeroplane towing speed (max.) 130 km.h. (81 m.p.h.).



The PIK-13 Single-seat High-performance Sailplane.

VALMET

VALMET OY, LENTOKONETEHDAS (Aircraft Factory).

Office and Works : Tampere.

The Aircraft Factory forms part of the concern known as the State Metal Works, which was established by bringing the former State Aircraft Factory and several other State-owned metal-working factories under a central management. The present Aircraft Factory, a direct continuation of the former State Aircraft Factory, belongs to the Tampere Factory Group which consists of the Aircraft Factory at Tampere, as the central unit, and the Kuorevesi Factory which undertakes aircraft repairs. The Linnavuori Factory at Siuro, near Tampere, is producing chiefly engines.

The current product of the Aircraft Factory is the Vihuri, a two-seat advanced training monoplane. The prototype VH-I flew for the first time on February 6, 1951. The first series of the Vihuri was produced for the Finnish Air Force in a slightly modified form as the Vihuri-II. The first production VH-II was flown on August 3, 1953.

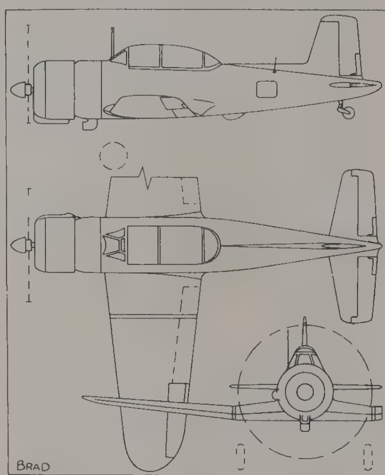
A second slightly-modified series of the Vihuri is now in production for the Finnish Air Force. It will be known as the Vihuri-III. The first Vihuri-III is expected to fly in the beginning of 1956.

THE VALMET VH-II VIHURI (SQUALL).

Type.—Two-seat Advanced Trainer.

Wings.—Low-wing cantilever monoplane. Wing section NACA 0019-64 (root), NACA 23009 (tip). Aspect ratio 5.7. Chord 2.49 m. (7 ft. 7 in.) at root, 1.2 m. (3 ft. 8 in.) at tip. Dihedral (outer wings) 5°. Incidence (at root chord) 3°. Sweepback 4° at 25% chord. Light alloy stressed-skin structure. Modified Frise-type ailerons have light-alloy frames and fabric covering. Light alloy split flaps inboard of ailerons. Total area of ailerons 1.46 m.^{2} (15.7 sq. ft.). Total area of flaps 1.85 m.^{2} (19.9 sq. ft.). Gross wing area 18.86 m.^{2} (202.9 sq. ft.).

Fuselage. Forward section of fuselage is a welded chrome-molybdenum steel tube structure with Alclad covering. Rear section is a light metal stressed-skin monocoque.



The Valmet VH-2 Vihuri.

Tail Unit.—Light alloy stressed-skin structure. Areas: fin 2.61 m.^{2} (28.0 sq. ft.), rudder 0.82 m.^{2} (8.8 sq. ft.), tailplane 2.79 m.^{2} (20.0 sq. ft.), elevators (total) 1.21 m.^{2} (13.0 sq. ft.). Tailplane span 3.74 m (12 ft. 3 in.).

Landing Gear.—Retractable tail-wheel type. Hydraulic retraction. Valmet oil/spring shock-absorbers. Valmet wheels, Dunlop tyres and Valmet hydraulic brakes. Track 2.64 m. (8 ft. 8 in.).

Power Plant.—One Bristol Mercury VIII nine-cylinder radial air-cooled engine rated at 820 h.p. at 2,650 r.p.m. at 4,100 m. (13,450 ft.) and with a maximum take-off power of 720 at 2,650 r.p.m. at sea level. Modified three-blade D.H. constant-speed metal airscrew. Two main rubber bag tanks (195 litres = 43 Imp. gallons each) and two auxiliary tanks (130 litres = 28.6 Imp. gallons each) in centre-section. Total fuel capacity 630 litres (138 Imp. gallons). Oil capacity 30 litres (6.5 Imp. gallons).

Accommodation.—Enclosed cockpit seating two in tandem (pupil in front) with dual controls. Sliding jettisonable Perspex canopy. Seats and rudder-pedals are adjustable. Provision for amber screening for blind-flying training. 24-volt electrical system. VHF transmitter/receiver, blind-approach equipment and radio compass.

Dimensions.—
Span 10.4 m. (33 ft. 1 in.).
Length 8.8 m. (28 ft. 9 in.).
Height 3.86 m. (12 ft. 8 in.).

Weights and Loadings.—
Max. loaded weight (normal fuel) 2,678 kg. (5,892 lb.).
Max. loaded weight (with auxiliary fuel) 2,884 kg. (6,345 lb.).
Wing loading (normal fuel) 142 kg./m.^{2} (29.11 lb./sq. ft.).
Power loading (normal fuel) 3.26 kg./h.p. (7.17 lb./h.p.).

Performance (at 2,678 kg. = 5,892 lb. A.U.W.).—
Max. speed 432 km.h. (268 m.p.h.) at 3,700 m. (12,140 ft.).
Econ. cruising speed 327 km.h. (203 m.p.h.) at 1,000 m. (3,280 ft.).
Landing speed 135 km.h. (83.8 m.p.h.).
Initial rate of climb 690 m./min. (2,263 ft./min.).
Rate of climb at 3,700 m. (12,140 ft.) 660 m./min. (2,165 ft./min.).
Service ceiling 8,900 m. (29,190 ft.).
Take-off to 15.25 m. (50 ft.) 700 m. (765 yds.).
Landing distance from 15.25 m. (50 ft.) 750 m. (820 yds.).

The Valmet VH-2 Vihuri Advanced Trainer (820 h.p. Bristol Mercury engine).

FRANCE

ADAM

ETABLISSEMENTS AÉRONAUTIQUES R. ADAM.

Head Office and Works : 85, Rue Hoche, Houilles (Seine-et-Oise).

The Etablissements Aéronautiques Roger Adam specialises in the design of light aircraft suitable for the amateur pilot. It has built the RA-14 Loisirs ; the higher-powered RA-15 ; and the RA-17, a single-seat development of the RA-15 intended for agricultural uses.

The company is, however, now concentrating its entire activities on the RA-14. This aircraft, of the simplest construction, is intended to be built by aero-clubs or private individuals, the company supplying all necessary drawings and fabricated parts and fittings at a third of the cost of a completed aircraft.

The Adam RA-14 Light Cabin Monoplane.

THE ADAM RA-14 LOISIRS.

Type.—Two-seat Light Cabin monoplane.

Wings.—High-wing rigidly-braced monoplane. Two-spar wood structure covered with fabric. Steel-tube Vee bracing struts. Wings arranged to fold. Slotted ailerons. Wing area 16 m.² (172 sq. ft.).

Fuselage.—Rectangular four-longeron structure covered with fabric.

Tail Unit.—Braced monoplane type. Wood frames, fabric covering.

Landing Gear. — Fixed divided type. Rubber-in-compression springing. Low-pressure wheels.

Power Plant.—Any engine of 40 to 65 h.p. A typical installation uses the 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine.

Accommodation.—Enclosed cabin seating two side-by-side with dual controls. Doors on each side of cabin.

Dimensions.—
Span 10.9 m. (35 ft. 9 in.).
Length 7.0 m. (22 ft. 11 in.).
Height 2.2 m. (7 ft. 2½ in.).

Weights.—
Weight empty 280 kg. (616 lb.).
Weight loaded 480 kg. (1,056 lb.).

Performance (65 h.p. Continental engine).—
Max. speed 140 km.h. (87 m.p.h.).
Landing speed 50 km.h. (31 m.p.h.).
Ceiling 4,000 m. (13,120 ft.).
Range 450 km. (280 miles).
Take-off run 100 m. (109 yds.).
Landing run 60 m. (66 yds.).

AUBERT

PAUL AUBERT.

Head Office : 6, Square Claude Debussy, Paris (17e).

Works : Buc Aerodrome, near Versailles (Seine-et-Oise).

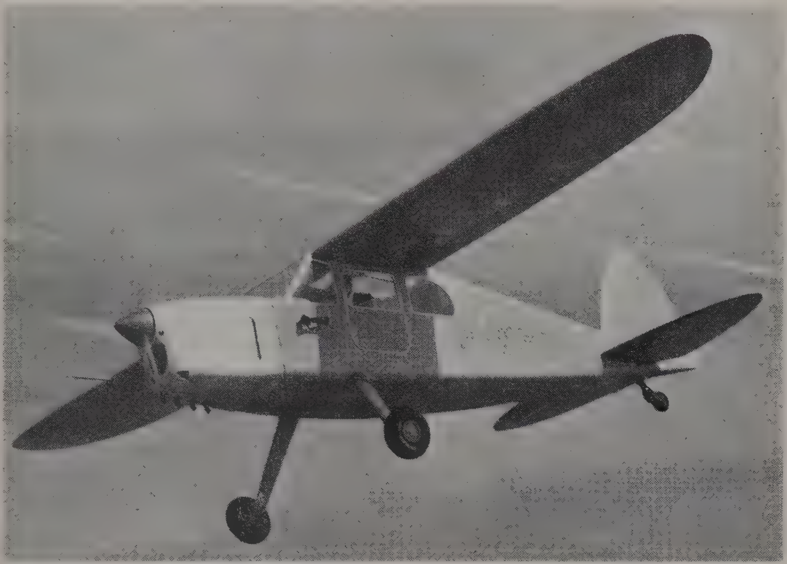
M. Paul Aubert, a pilot of the 1914-18 war, formed Aubert-Aviation in 1932 and in 1936 began the design of aircraft. The first aircraft he built was the PA-20 Cigale, a side-by-side trainer, which after successful trials, was exhibited at the 1938 Paris Salon.

In 1938 Aubert-Aviation became the Société Anonyme des Avions P. Aubert. Considerable sub-contract work was undertaken for the nationalised aircraft industry and a direct contract for a production of a number of Morane-Saulnier M.S. 230 trainers was placed with the company by the French Government. All this work ceased in June, 1940.

After the war Aubert revised the PA-20, the prototype of which had been destroyed during the occupation. In its revised form as the PA-201, and powered by a 140 h.p. Renault engine, it won many competitions.

The current development of this original design is the PA-204 Super-Cigale, the prototype of which flew in April, 1949 and received its Certificate of Airworthiness in November, 1951. A series of ten was put in hand in 1954. The first PA-204 flew for the first time on August 11, 1954.

Paul Aubert now occupies two hangars on Buc aerodrome, loaned to him by Blériot Aéronautique.



The Aubert PA-204 Cigale-Major Cabin Monoplane.

THE AUBERT PA-204 CIGALE-MAJOR.

Type.—Four-seat Touring monoplane.

Wings.—High-wing cantilever monoplane. Aspect ratio 7.8. One-piece all-wood wing with elliptical outer sections. Entire trailing-edge hinged, outer sections as ailerons, inner sections as flaps. Gross wing area 12.92 m.² (139 sq. ft.).

Fuselage.—All-wood monocoque structure.

Tail Unit.—Cantilever monoplane type. All-wood structure. Adjustable tailplane. Areas : fin 0.59 m.² (6.35 sq. ft.), rudder 0.77 m.² (8.28 sq. ft.), tailplane 1.55 m.² (16.62 sq. ft.), elevators 1.65 m.² (17.75 sq. ft.). Tailplane span 3.80 m. (12 ft. 5½ in.).

Landing Gear.—Fixed tail-wheel type. Main cantilever legs are sprung within the fuselage by rubber blocks. Orientable tail-wheel. Track 2.80 m. (9 ft. 2 in.).

Power Plant.—One 170 h.p. SNECMA 4 L 21 four-cylinder in-line inverted air-cooled engine. Two-blade Merville wood airscrew 2.03 m. (6 ft. 8 in.) in diameter. Two fuel tanks (75 litres = 16.5 Imp. gal. each) in wing, one on each side of fuselage.

Accommodation.—Enclosed cabin seating four in two pairs. Two upward-hinged doors, one on each side.

Dimensions.—
Span 10.0 m. (32 ft. 9 in.).
Length 7.40 m. (24 ft. 3 in.).
Height 2.40 m. (7 ft. 10 in.).

Weights and Loadings.—
Weight empty 640 kg. (1,408 lb.).
Weight loaded 1,160 kg. (2,552 lb.).
Wing loading 90 kg./m.² (18.45 lb./sq. ft.).
Power loading 8.40 kg./h.p. (18.48 lb./h.p.).

Performance.—
Max. speed at S/L. 240 km.h. (149 m.p.h.).
Cruising speed (75% power) 215 km.h. (133.5 m.p.h.).
Climb to 360 m. (1,180 ft.) 2 min. 15 sec.
Service ceiling 4,000 m. (13,120 ft.).
Cruising range 1,200 km. (745 miles).
Take-off distance to 20 m. (66 ft.) 550 m. (600 yds.).
Landing distance from 20 m. (66 ft.) 530 m. (560 yds.).

BOISAVIA

AVIONS BOISAVIA.

Head Office : 11, Rue Pierre-Brossolette, Ivry-sur-Seine.

The principal product of Boisavia, which is under the direction of M. Lucien Tielès, is the B-60 Mercurey, a four-seat cabin monoplane which has been developed from the earlier B-50 Muscadet three-seater.

The latest production is the B-260 Anjou, a twin-engined cabin monoplane. Boisavia has an agreement with S.N.C.A.N. whereby it has the use of the workshops, machinery and personnel of the latter company's plant at Méaulte for the construction of a small pre-series of five B-260 Anjou twin-engined monoplanes.

THE BOISAVIA B-260 ANJOU.

The B-260 is a twin-engined 4/5-seat monoplane of conventional layout. The prototype will be powered by two 170 h.p. SNECMA 4 L 02 engines. It was expected to fly late in 1955.

The structure is mainly of metal with a welded steel-tube fuselage covered with fabric and a metal-framed monospar wing covered with metal forward of the spar and with fabric aft.

The constant-chord wing, which has an aspect ratio of 7.7, is fitted with wing fences and wing-tip "balonets" which have an aerodynamic function. They

may ultimately be replaced by wing-tip tanks.

DIMENSIONS.—
Span 12.85 m. (42 ft. 1 in.).
Length 6.875 m. (22 ft. 6 in.).
Height 3.10 m. (10 ft. 2 in.).

WEIGHTS AND LOADINGS (Designed).—
Weight empty 855 kg. (1,880 lb.).
Weight loaded 1,550 kg. (3,410 lb.).
Wing loading 72 kg./m.² (14.76 lb./sq. ft.).
Power loading 5.74 kg./h.p. (12.62 lb./h.p.).

PERFORMANCE (Estimated).—
Max. speed at S/L. 263 km.h. (163 m.p.h.).
Cruising speed at S/L. 238 km.h. (148 m.p.h.).
Cruising speed at 1,500 m. (4,920 ft.) 230 km.h. (143 m.p.h.).
Max. speed at S/L. on one engine 180 km.h. (112 m.p.h.).
Max. speed at 1,500 m. (4,920 ft.) on one engine 160 km.h. (100 m.p.h.).
Service ceiling 6,000 m. (19,680 ft.).

The Boisavia B-60 Mercurey (140 h.p. SNECMA 4 Pei engine).

THE BOISAVIA B-60 MERCUREY.

Apart from the basic B-60 version, the full specification of which is given below, the following variants have been built :—

B-601. Agricultural version of the B-60. Fitted with a 190 h.p. Lycoming engine.

B-602. Similar to B-60 but fitted with a 165 h.p. Continental engine.

B-603. Developed specifically as a glider-tug. Powered by a 240 h.p. Salmson As 10 engine. In official tests, towing a Nord 2000 sailplane, the B-603 has taken off in 120 m. (393 ft.), climbed to 1,000 m. (3,280 ft.) in 3½ minutes and reached 5,600 m. (18,370 ft.) in 56 minutes.

B-604. Glider-tug. Development of the B-603 with longer fuselage, higher fin and a new landing-gear. Powered by a 230 h.p. Salmson 9 Abc radial engine. Prototype flew on January 6, 1954.

B-605. Four-seat tourer and trainer. Similar to B-60 except fitted with 170 h.p. SNECMA Regnier 4L 02 engine. First flew on April 29, 1954.

TYPE.—Four-seat Cabin monoplane.

WINGS.— High-wing rigidly-braced monoplane. NACA 23.012 wing section. Two-spar wooden structure with stressed plywood skin. Vee bracing-struts. Slotted aerodynamically-balanced ailerons. Built-in leading-edge slots ahead of ailerons. Trailing-edge flaps between ailerons and fuselage. Wing area 18 m.² (193.6 sq. ft.).

FUSELAGE.— Welded steel-tube structure covered with fabric.

TAIL UNIT.—Cantilever monoplane type. Tailplane structure similar to that of wings. Balanced elevators and rudder. Trim-tabs, adjustable on ground, in port elevator and rudder.

LANDING GEAR.—Fixed type with divided axle. Differential wheel brakes. Steerable tail-wheel.

POWER PLANT.—One 140 h.p. SNECMA 4 Pei four-cylinder in-line inverted air-cooled engine driving a two-blade fixed-pitch airscrew. Alternative engines include the 165 h.p. Continental and 190 h.p. Lycoming flat-four power-units. Fuel tanks in wing roots.

ACCOMMODATION.—Cabin seats four in two pairs with dual controls to the front pair. One-piece windscreen, transparent roof and fairing over rear seats. Large door on each side opens upward for access to both front and rear seats. Baggage compartment at back of cabin accessible from inside. Soundproofing, heating and ventilation. Passenger seats quickly removable so that cabin may be used for light freight.

DIMENSIONS.—
Span 11.38 m. (37 ft. 4 in.).
Length 7.10 m. (23 ft. 3 in.).
Height 2.10 m. (6 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty 520 kg. (1,444 lb.).
Weight loaded 1,000 kg. (2,200 lb).
Wing loading 55 kg./m² (11.27 lb./sq. ft.).
Power loading 7 kg /h.p. 15.4 lb./h.p.).

PERFORMANCE (140 h.p. Renault engine).—
Max. speed 235 km.h. (146 m.p.h.).
Cruising speed 190 km.h. (118 m.p.h.).
Landing speed 60 km.h. (37.2 m.p.h.).
Initial rate of climb 240 m./min. (790 ft. min.).
Ceiling 5,500 m. (18,040 ft.).
Range 1,100 km. (683 miles).
Take-off run 135 m. (147 yds.).
Landing run 60 m. (65 yds.).

The Boisavia B-603 Mercurey Glider-tug (240 h.p. Salmson engine).

BREGUET

SOCIETE ANONYME DES ATELIERS D'AVIATION LOUIS BREGUET.

HEAD OFFICE: 24, RUE GEORGES-BIZET, PARIS (XVIe).

WORKS: VILLACOUBLAY (SEINE-ET-OISE), TOULOUSE (HAUTE-GARONNE) AND BAYONNE (BASSES PYRÉNÉES).

President and Director-General: Sylvian Floriat.

General Manager: Jean Gandilhon.

The Breguet company was founded in 1911 by M. Louis Breguet, one of the great pioneers of French aviation, who died on May 4, 1955, at the age of 75.

Breguet was incorporated into the nationalised industry in 1936, but three years later regained some measure of independence through the purchase of the former Latécoère factories at Toulouse, Bayonne and Biscarosse.

In 1954 the company continued the development and testing of the Type 960 Vultur which was designed for the French Navy, and is now developing a lighter version, the Type 1050, which will be able to operate for the light aircraft-carriers now in service with the Navy. The Type 1050 is being designed primarily for "hunter-killer" anti-submarine operations and will incorporate the lessons learnt with the Type 965, a modified Type 960 prototype, which was being flight-tested in 1955.

Breguet is developing a family of aircraft which will employ the "blown-wing" principle of high lift to provide short take-off and landing runs and, eventually, it is hoped, V.T.O. The principle involves the use of four large-diameter propellers equally distributed spanwise and large double flaps. The slipstream of the propellers gives, even at zero forward speed, an important amount of lift. The first aircraft in this series will be the Type 940, a freighter designed to carry a load of 3 tons over a range of 960 km. (600 miles), and to take-off with fuel load in less than 55 m. (60 yards). The Type 941 will be a military - assault - transport of similar configuration to the Type 940. Both will be powered by Turbomeca turboprop engines.

During 1954 the last five of twelve Type 763 "Deux-Ponts" were delivered to Air France and all twelve now serve on the North African routes. During the year these aircraft made 3,400 Mediterranean crossings, carrying 187,000 passengers and 13,600 tonnes (13,385 tons) of freight.

Breguet is building, in its Anglet plant, wings for the Nord 2501 twin-engined transport which is in production for the French Air Force. It is also producing in series, under a Rotol license, the airscrews for this transport.

The Breguet Sailplane Division is under the technical direction of M. Jarlaud, the well-known specialist in high-performance sailplanes.

Two prototypes of the Type 901 sailplane flew in 1954. Both were entered in the International Gliding Championship Meeting held in England in July-August, 1954, one piloted by Gérard Pierre, winning the single-seater World Championship and the other taking seventh place.

Three other prototypes will be completed in 1955, the Type 902 two-seat trainer, the Type 903 high-altitude sailplane with pressurised cockpit, and the Type 904, a two-seat version of the 901.

Breguet is also engaged in the design and development of convertiplanes, and other advanced aircraft projects, as well as in the development of pre-stressed concrete aircraft and missile structures.

THE BREGUET TYPE 1001 TAON.

The Type 1001 is a single-seat light-weight ground attack fighter which has been designed to meet the NATO specification for a tactical fighter, with emphasis on maximum speed at sea level, high manoeuvrability in roll and good take-off and landing performances on unprepared strips In the evaluation of the designs by NATO, the Type 1001 was placed first. Three prototypes have been ordered.

The Taon (Gadfly or Horsefly) is a small swept-wing monoplane which will be powered by a Bristol Orpheus turbojet engine (1,490 kg. = 3,285 lb./s.t.). All wheels of the tricycle landing-gear retract into the fuselage. It will have a maximum take-off weight of 4,090 kg. (9,000 lb.).

No other details were available for publication at the time of writing.

THE BREGUET TYPE 1100.

The Type 1100 is a slightly larger twin-engined version of the Type 1001 which has been designed to a French Air Ministry

The Breguet Type 960 (one Armstrong Siddeley Mamba turboprop and one Hispano-Suiza Nene turbojet engine).

specification and has been ordered by the French Government. It will be powered by either two SNECMA R.105 Vesta, Hispano-Suiza R.800 or Turbomeca Gabizo turbojet engines, the engines being located in the centre fuselage with paired jet pipes terminating side-by-side aft of the tail unit.

No other details were available for publication at the time of writing.

THE BREGUET TYPE 960 VULTUR.

The Type 960 was designed as a twin-engined two-seat Naval Strike aircraft with a composite turbojet-turboprop power-plant. It is a low-wing cantilever monoplane with retractable tricycle landing-gear and single-ruddered tail-unit. The crew of two is seated side-by-side and both members of the crew have ejection seats. The armament will consist of rockets, bombs and other special stores.

The power-plant consists of an Hispano-Suiza Nene turbojet in the rear fuselage and exhausting at the tail, and an Armstrong Siddeley Mamba turboprop in the nose.

The first of two 960 prototypes flew for the first time on August 3, 1951. The second prototype fitted with a higher-powered Mamba 3 engine made its first flight on September 15, 1952. This second prototype underwent with success a complete testing programme of simulated carrier operations, with catapult-assisted take-off and arrested landing, at the Royal Aircraft Establishment, Farnborough, England under the control of the British Ministry of Supply.

No orders having materialised for the Type 960 in its original form, the two prototypes have been altered as follows.

960-01. First prototype. The Nene engine has been adapted to blow compressed air through injectors to control the boundary layer on the flaps. This programme is being conducted in co-operation with O.N.E.R.A. which undertook part of the wind-tunnel tests.

960-02. Second prototype. Has been modified to serve as a flying mock-up for the Type 1050. The mock-up is primarily intended to check the operation of the electronic equipment, the dispositions of the crew of three, and the development and test of all the equipment specified for the Type 1050. In its modified form this aircraft is known as the Type 965 (which see).

THE BREGUET TYPE 965.

The Type 965 is the modified Type 960 second prototype which is being used as a flying mock-up of the Type 1050. The Nene engine has been removed and replaced by a retractable radar scanner, an additional cockpit has been provided for the third member of the crew, and considerable electronic equipment and provisions for bomb and rocket armament have been added.

The Type 965 made its first flight on March 26, 1955.

THE BREGUET 1050.

The Type 1050 is a three-seat anti-submarine "hunter-killer" carrier-based aircraft derived from the Type 960. The Nene engine has been removed and replaced by a retractable radar scanner. The airframe will be lighter and the landing-gear simplified. The wings and tail-unit will differ slightly from those of the Type 960.

The Type 1050 will be powered by a Rolls-Royce Dart RDa 6 Mk. 510 turboprop engine. Its armament will consist chiefly of bombs and rockets.

The first prototype Type 1050 is expected to fly in the summer of 1956. Five pre-production aircraft are being built and production orders for two batches of 50 have already been placed, production to begin in 1956.

DIMENSIONS.—
Span 15.3 m. (50 ft. 2 in.).
Length 13.7 m. (45 ft.).

THE BREGUET TYPE 940.

The Type 940 will be the first of a series of designs incorporating what the company calls the "blown wing" principle. A prototype is under construction.

The Type 940, which is designed as a civil freighter, has a high unbraced wing, the entire leading-edge of which is in the slipstream of four large diameter airscrews which will be driven by Turbomeca Turmo turboprop engines. The four airscrews will be linked by a transverse shaft so that engine failure will not stop any one airscrew. The wings are provided with large double flaps with boundary layer control.

It is claimed the slipstream of the airscrews gives, even at zero forward speed, considerable lift and will permit the Type 940 fixed-wing aircraft to possess helicopter-like take-off and landing characteristics.

The Type 940 with an all-up weight of 6½ tonnes (13,290 lb.) will have a take-off run of 55 m. (60 yards). No further details were available at the time of going to press.

THE BREGUET TYPE 941

The Type 941 is a project for a military version of the Type 940. Its general layout will be similar to the civil model but provision is made for rear ramp loading similar to that employed on the Type 763 Deux-Ponts. No other details are available.

THE BREGUET TYPE 763 DEUX-PONTS.

The Breguet 763 is a development of the Type 761, the design of which was begun in 1944. The prototype 761 fitted with four 1,600 h.p. Snecma 14R engines flew for the first time on February 15, 1949, and was awarded a certificate of airworthiness at an all-up weight of 40,000 kg. (88,000 lb.).

A pre-series of three aircraft, designated Type 761 S, was then put into production, the first making its first flight in 1951. These three aircraft are identical to the prototype except that they are powered with four 2,000 h.p. Pratt & Whitney R-2800 B31 engines driving Ratier reversible-pitch airscrews. This type was awarded a C. of A. at a gross weight of 45,000 kg. (99,000 lb.).

The next twelve aircraft, known as the Type 763, were ordered by Air France in 1951. They are fitted with four 2,400 h.p. Pratt & Whitney R-2800 CA18 engines driving Hamilton Standard reversing airscrews. The fuselage is generally the same but span is increased and the wings reinforced. Furthermore the accommodations have been completely redesigned to meet Air France's requirements for a convertible passenger/cargo aircraft. The flight compartment has also been re-arranged to meet Air France's request for the reduction of the flight crew from four to three.

The prototype Type 763 made its maiden flight on July 20, 1951, and was awarded a C. of A. for a take-off weight of 48,000 kg. (105,600 lb.), since increased to 51,600 kg. (113,800 lb.).

The Type 763, which is used by Air France under the type name "Provence," is equipped to accommodate 107 passengers, 59 "tourist" class on the upper deck and 48 second class on the lower deck. The lower deck can, however, be quickly adapted in whole or in part for the carriage of freight by folding the passenger seats against the cabin walls and where both passengers and freight are carried, by inserting a removable bulkhead between the two compartments.

In Autumn, 1954, military tests were conducted in co-operation with the Parachute Troop section of the French Army. The programme included the dropping of a "stick" of 150 airborne infantrymen, transporting a medium tank and a fully-equipped 105 mm. battery. One of the three pre-series Type 761S's dropped a number of parachute supply units up to individual weights of 6,000 kg. (13,200 lb.). On one occasion 14.5 tonnes (14,724 kg. = 34,029 lb.) was dropped in the space of 18 seconds. An order for thirty 763M military freighters has since been placed.

The Breguet Type 763 Deux-Ponts Transport (four 2,400 h.p. Pratt & Whitney R-2800 CA18 engines).

The description which follows refers to the Type 763 as used by Air France.

Type.—Four-engined Convertible Passenger or Freight Transport.

Wings.—Cantilever mid-wing monoplane. Aspect ratio 9.95. Light alloy structure with stressed metal skin. Metal ailerons each in three-sections on outer wings. Area (each) 9.2 m.² (99 sq. ft.). Breguet slotted flaps in four sections each side between ailerons and fuselage. Hydraulic actuation. Total flap area 27.51 m.² (296 sq. ft.). Gross wing area 185.4 m.² (1,996 sq. ft.).

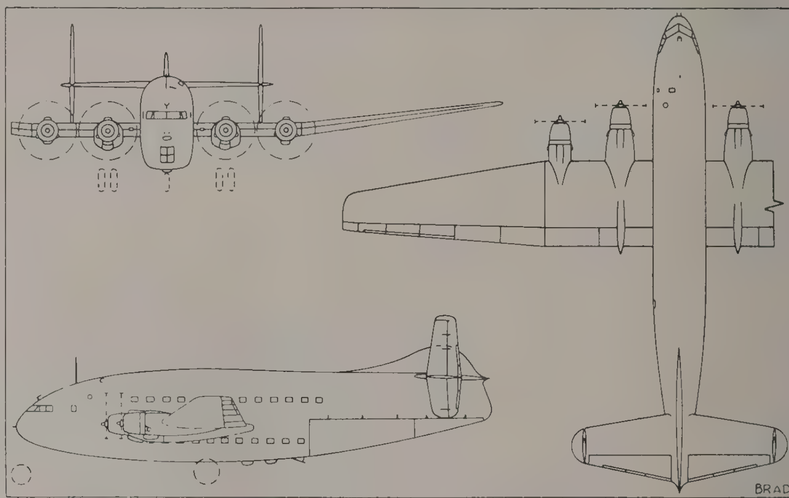
Fuselage.—Two-deck monocoque in five main sections. Duralumin structure with stressed metal skin. Max. fuselage width 3.30 m. (10 ft. 9½ in.), max. depth 5.0 m. (16 ft. 5 in.).

Tail Unit.—All-metal cantilever structure consisting of tailplane mounted at top of fuselage with elevators on each side of central dorsal fin. Inset from tips of tailplane are the two-piece fins and rudders, latter with three trim and balance tabs each. Total horizontal area 41.90 m.² (449 sq. ft.). Total vertical area 21.98 m.² (236 sq. ft.). Dorsal fin area 7.12 m.² (76.8 sq. ft.).

Landing Gear.—Retractable tricycle type. Messier shock struts to all wheels. Twin main wheels, single nose wheel, hydraulic retraction. Track 7.98 m. (26 ft. 2 in.).

Power Plant.—Four Pratt & Whitney R-2800 CA18 eighteen-cylinder two-row radial air-cooled engines delivering 2,400 h.p. at take-off with water injection. Hamilton Standard 43 E 60 three-blade constant-speed and reversing airscrew, 4.216 m. (13 ft. 8 in.) diameter. Total fuel capacity 15,300 litres (3,366 Imp. gallon); two 3,220 litre (708 Imp. gallon) tanks in outer wings; two 4,130 litre (908 Imp. gallon) tanks in centre-section and two 300 litres (66 Imp. gallon) reserve tanks one in each outer engine nacelle. Oil capacity 800 litres (173 Imp. gallons) in four tanks.

Accommodation.—Fuselage divided into two decks. Crew compartment in nose on upper deck with accommodation for three. The standard accommodation provides for the upper deck to seat 59 tourist passengers and the lower deck to seat 48 second-class passengers. The upper deck also includes a galley providing food service for 59 passengers, seat for hostess and toilets fore and aft. The lower deck, which is provided with seats which may be folded against the walls, may be adapted in whole or in part for the carriage of freight. When both passengers and freight are carried removable bulkheads then separate the passenger accommodation from freight hold. Loading and unloading of freight hold through large rear panels beneath rear fuselage, operated by hydraulic jacks. Normal access for passengers through lateral doors in closed freight-loading panels aft and then by staircase to upper deck. A door on front starboard side for passengers or for loading small pieces of freight. Volume of lower deck 83.1 m.³ (2,934 cub. ft.). Lower deck floor 1.30 m. (4 ft.) from ground permitting direct loading from trucks.



The Breguet Type 763 Deux-Ponts Transport.

Dimensions.—
- Span 42.99 m. (140 ft. 5 in.).
- Length 28.94 m. (94 ft. 11 in.).
- Height 9.91 m. (32 ft. 7 in.).

Weights.—
- Weight empty 32,241 kg. (71,080 lb.).
- Crew (5) 400 kg. (880 lb.).
- Fuel and oil 8,115 kg. (17,890 lb.).
- Passengers (upper deck) 4,425 kg. (9,755 lb.).
- Freight and baggage (lower deck) 6,419 kg. (14,160 lb.).
- Max. take-off weight 51,600 kg. (113,800 lb.).
- Max. landing weight 48,000 kg. (96,560 lb.).

Performance.—
- Max. cruising speed 380 km.h. (231 m.p.h.) at 3,050 m. (10,000 ft.).
- Economic cruising speed 336 km.h. (210 m.p.h.) at 3,000 m. (9,840 ft.).
- Rate of climb at S/L. 331 m./min. (1,080 ft./min.).
- Rate of climb at 2,300 m. (5,000 ft.) 248 m./min. (813 ft./min.).
- Rate of climb at S/L. (on 3 engines) 140 m./min. (460 ft./min.).
- Climb to 3,000 m. (9,840 ft.) 22 min.
- Take-off run to clear 15 m. (50 ft.) 1,700 m. (1,866 yds.).
- Landing distance from 15 m. (50 ft.) 1,100 m. (1,200 yds.).
- Max. range in still air (with 10% reserve of cruise fuel and allowance for 1 hour stacking and 300 km. diversion) at full load and max. cruising speed 2,050 km. (1,280 miles).
- Max. range (as above—at economic cruising speed) 2,290 km. (1,430 miles).
- Max. range with full tanks at above conditions 3,400 km. (2,100 miles) at max. cruising, and 4,100 km. (2,550 miles) at economic cruising.

THE BREGUET TYPE 900.

The Type 900 sailplane was built in the Toulouse factory of the Breguet company and on its maiden flight on May 13, 1949, flew a distance of 470 km. (292 miles) at an average speed of 90 km.h. (56 m.p.h.) which, if observed, would have established a new French goal flight record.

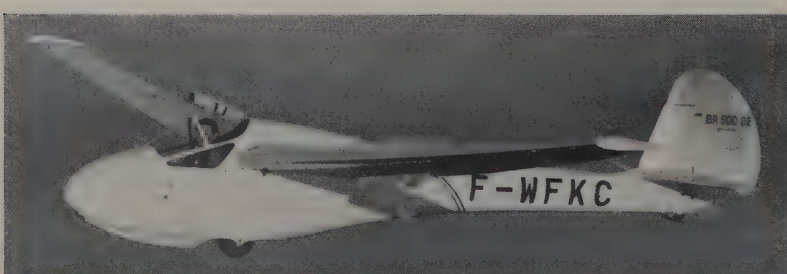
Type.—Single-seat High-performance Sailplane.

Wings.—Shoulder-wing cantilever monoplane. Aspect ratio 15.85. Single spruce and plywood spar with D-nose of plywood and overall fabric covering. Slotted ailerons, with 25° upward and 15° downward movement, on outer halves of each half span, with slotted flaps, with 40° downward movement, inboard. Metal dive brakes on upper and lower surfaces. Gross wing area 12.9 m.² (138.8 sq ft.).

Fuselage.—Wood structure with plywood skin. Fin integral with rear fuselage.

Tail Unit.—Cantilever monoplane type.

Landing Gear.—Single skid, followed by single Messier wheel with brake, and sprung tail-skid aft.



The Breguet Type 900 Single-seat Sailplane.

ACCOMMODATION.—Single enclosed cockpit. Provision for back-type parachute.
DIMENSIONS.—
Span 14.30 m. (46 ft. 11 in.).
Length 6.50 m. (21 ft. 4 in.).
WEIGHTS.—
Weight empty 200 kg. (440 lb.).
Weight loaded 290 kg. (638 lb.).
PERFORMANCE.—
Max. speed 72 km.h. (44.7 m.p.h.).
Sinking speed at 100 km.h. (62 m.p.h.) 1.50 m./sec. (4.9 ft./sec.).
Min. sinking speed 0.70 m./sec. (2.3 ft./sec.).

THE BREGUET TYPE 901.

The Type 901, which is a direct development of the 900, took first place in the 1954 World Championship contest for single-seat sailplanes. It is now in production.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Shoulder-wing cantilever monoplane. NACA 63 Series laminar-flow wing section. Aspect ratio 20. Structure as for Type 900 except leading-edge torsion box is made of plywood-klegecell sandwich. Gross wing area 15 m.² (161 sq. ft.).

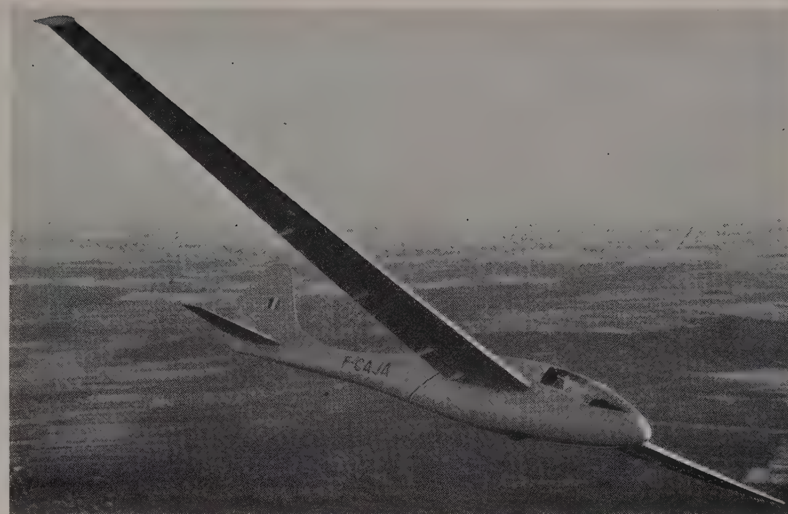
FUSELAGE.—Same as for Type 900.

TAIL UNIT.—Cantilever monoplane type. Horizontal tail-surfaces can be folded. Total horizontal area 2.07 m.² (22.3 sq. ft.), total vertical area 1.02 m.² (11 sq. ft.).

LANDING GEAR.—Single retracting wheel with hydraulic brake. Local reinforcement of fuselage around wheel allows wheel up without serious damage to structure, while drag saving due to removal of skid is substantial.

ACCOMMODATION.—Single cockpit with flush canopy. Radio, blind-flying equipment and oxygen are provided.

DIMENSIONS.—
Span 17.32 m. (56 ft. 10 in.).
Length 7.16 m. (23 ft. 4 in.).
WEIGHTS.—
Without water ballast 315 kg. (694 lb.).
With water ballast 390 kg. (860 lb.).
PERFORMANCE.—
Max. L/D. ratio 36.
Min rate of sink 10.60 m./sec. (118 ft./min.) at 72 km.h. (45 m.p.h.).
Max. speed at safe load 225 km.h. (140 m.p.h.).



The prototype Breguet Type 901 High-performance Sailplane.

BROCHET

AVIONS MAURICE BROCHET.

HEAD OFFICE AND WORKS: 12 RUE SAINT-MARTIN, NEAUPHLÉ-LE-CHATEAU (S.-ET-O.).

M. Maurice Brochet specialises in the design of light aircraft for the amateur constructor. His designs are conceived with the greatest simplicity so that, with the aid of a complete set of working drawings, they may be built by private individuals, aero-clubs, etc., with the simplest of equipment and materials.

Of the latest Brochet aircraft, ten M.B. 70's, ten M.B. 80's, five M.B. 100's and fifteen M.B. 101's have been built for the S.F.A.S.A. (formerly S.A.L.S.) for distribution among French flying clubs. The first production M.B. 100 flew for the first time on March 25, 1953.

The latest product of the company is the M.B. 120 two-seat light cabin monoplane, the prototype of which flew for the first time on April 5, 1954.

THE BROCHET M.B. 70.

TYPE.—Two-seat Light Cabin monoplane.

WINGS.—High-wing braced monoplane. Two-spar wood structure covered with fabric. Vee bracing struts. Wing area 14 m.² (151 sq. ft.).

FUSELAGE.—Rectangular wood structure.

TAIL UNIT.—Cantilever monoplane type. Wood framework covered with fabric.

LANDING GEAR.—Fixed type. Two faired side Vees and two half axles, the latter hinged to a tubular Vee cabane beneath the fuselage. Rubber cord shock-absorbers. Lockheed wheel brakes. Solid rubber tail-wheel interconnected with rudder-bar.

The Brochet M.B. 71 (75 h.p. Minié 4.DC.32 engine).

POWER PLANT.—One 45 h.p. Salmson 9ADB nine-cylinder radial air-cooled engine. Two wing fuel tanks with a total capacity of 70 litres (15.5 gallons).

ACCOMMODATION.—Enclosed cabin seating two in tandem with dual controls. Upward-opening door on each side.

DIMENSIONS.—
Span 10.35 m. (34 ft. 6 in.).
Length 6.50 m. (21 ft. 4 in.).

THE BROCHET M.B. 71.

The M.B. 71 is similar to the M.B. 70 except that it is fitted with a 75 h.p. Minié 4.DC.32 flat-four engine. The total fuel capacity is increased to 80 litres (18 Imp. gallons).

DIMENSIONS.—
Same as M.B. 70.
WEIGHTS.—
Weight empty 347 kg. (763 lb.).
Weight loaded 550 kg. (1,210 lb.).
PERFORMANCE.—
Max. speed 163 km.h. (101 m.p.h.).
Cruising speed 145 km.h. (90 m.p.h.).
Initial rate of climb 240 m./min. (787 ft./min.).
Climb to 350 m. (1,150 ft.) 2 min. 20 sec.

THE BROCHET M.B. 80.

The M.B. 80 is a development of the M.B. 71. The fuselage is 10.2 cm. (4 in.) wider, all control surfaces are balanced, the landing-gear is of the steel spring type as fitted to the M.B. 100 and the engine is a 75 h.p. Minié 4DC.32B flat-four.

A series of ten is being built for the S.A.L.S.

The Brochet M.B. 100 (90 h.p. Hirth 504 engine).

THE BROCHET M.B. 100.

The M.B. 100 is a three-seat development of the M.B. 70. The cabin seats two side-by-side with dual controls in front, with the third seat centrally-placed behind.

The M.B. 100, which is not intended for the amateur constructor, has a steel tube fuselage and a Cessna-type spring steel cantilever landing-gear. It is powered with a 91 h.p. Hirth 504 four-cylinder in-line inverted air-cooled engine.

DIMENSIONS.—
Span 10.66 m. (34 ft. 11 in.).
Length 6.50 m. (21 ft. 4 in.).
Wing area 14.23 m.² (153 sq. ft.).
Height 2.0 m. (6 ft. 7 in.).

Weights and Loadings.—
Weight empty 465 kg. (1,023 lb.).
Weight loaded 780 kg. (1,716 lb.).
Wing loading 54 kg./m.² (11 lb./sq. ft.).
Power loading 8.66 kg./h.p. (18 lb./h.p.).
Performance.—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 165 km.h. (102.4 m.p.h.).
Landing speed 55 km.h. (34 m.p.h.).
Rate of climb 180 m./min. (590 ft./min.).
Service ceiling 3,500 m. (11,480 ft.).
T.O. run 180 m. (196 yds.).
Landing run 160 m. (175 yds.).
Range 600 km. (375 miles).

THE BROCHET M.B. 101.

The M.B. 101 differs from the M.B. 100 by having an air filter and suitable external finish for service in North Africa. Fifteen have been built for use in schools in North Africa.

THE BROCHET M.B. 120.

The M.B. 120 is a two-seat light touring monoplane, the prototype of which flew for the first time on April 5, 1954. It has the air frame of the M.B. 100 remodelled as a two-seater, to which has been fitted the lighter wings, with landing-flaps, of the M.B. 80. The M.B. 120 is powered by a 90 h.p. Continental C90 flat-four engine.

The Brochet M.B. 120 (90 h.p. Continental C90 engine).

Dimensions.—
Span 10.66 m. (34 ft. 11 in.).
Length 6.50 m. (21 ft. 4 in.).
Height 2.0 m. (6 ft. 6 in.).
Weights and Loadings.—
Weight empty 505 kg. (1,111 lb.).
Weight loaded 765 kg. (1,683 lb.).
Wing loading 52 kg./m.² (10.66 lb./sq. ft.).
Power loading 8.5 kg./h.p. (18.7 lb./h.p.).
Performance.—
Max. speed 195 km.h. (121 m.p.h.).
Cruising speed 170 km.h. (105.5 m.p.h.).
Service ceiling 5,000 m. (16,400 ft.).
Range 800 km. (500 miles).
Take-off run 200 m. (218 yds.).
Landing run 180 m. (196 yds.).

C.A.B.

CONSTRUCTIONS AÉRONAUTIQUES DU BÉARN (C.A.B.).

Head Office: 32, Avenue Bié-Moulié, Pau (Basses-Pyrénées).

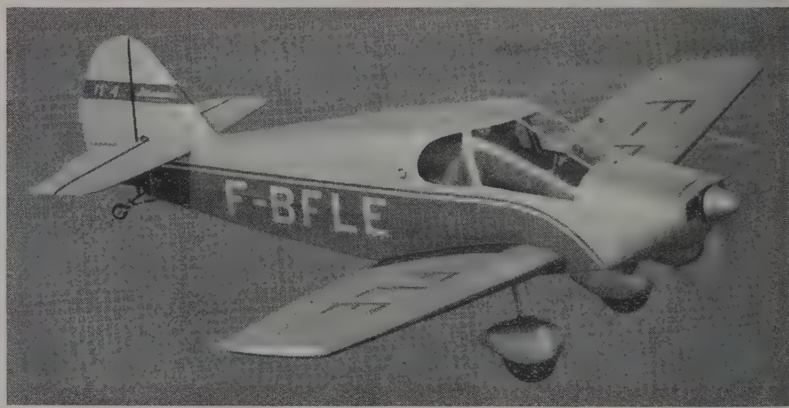
Works: Pau-Idron Airport, Pau (Basses-Pyrénées).

This concern builds the Minicab two-seat light monoplane which, in 1949, won the Coupe de Deauville (1st in all categories), the Grand Prix Aérien de Vichy and the Concours d'Elégance de Biarritz. The prototype received its airworthiness certificate in April, 1949.

A series of ten Minicabs has been built for the Service de la Formation Aéronautique et de Sports Aériens (formerly S.A.L.S.).

A development of the Minicab, known as the Supercab, fitted with a retractable landing-gear and powered with a 90 h.p. Continental engine, has been built and flown. Its first flight was made on February 5, 1954. Six have been built, two for the S.F.A.S.A.

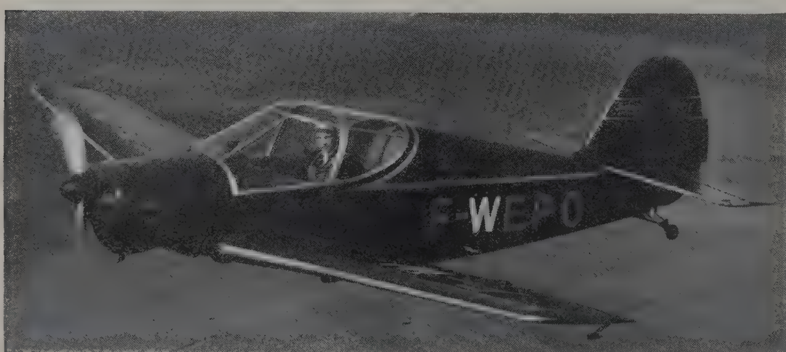
Both the Minicab and Supercab were designed by M. Yves Gardan, a young engineer who was also responsible for the design of the SIPA 200 Minijet and the SIPA 300 jet-powered light aircraft.



The C.A.B. Minicab (65 h.p. Continental A65 engine).

THE C.A.B. YG-20 MINICAB.

Type.—Two-seat Light monoplane.
Wings.—Low-wing cantilever monoplane in one piece attached to fuselage by four bolts. One main and one auxiliary spar, girder ribs, plywood leading-edge and overall fabric covering. Slotted ailerons. Flaps between ailerons and fuselage. Wing area 10.15 m.² (109.2 sq. ft.).
Fuselage.—Wood framework with fabric covering.
Tail Unit.—Cantilever monoplane type. Fin integral with fuselage. One-piece tailplane with plywood covering attached to fuselage at four points. Wood framed fabric-covered one-piece elevator and rudder. Trim tabs in movable surfaces.
Landing Gear.—Fixed tail-wheel type. Cantilever main legs with rubber-block springing. Mechanical wheel brakes. Orientable tail wheel.
Power Plant.—One 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine driving a Merville two-blade wood airscrew 1.64 m. (5 ft. 4 in.) diameter. Fuel tank in fuselage. Fuel capacity 50 litres (11 Imp. gallons).
Accommodation.—Enclosed cabin seating two side-by-side with dual controls. One-piece Rhodoid windscreen may be jettisoned in emergency. Baggage compartment behind seats and accessible in flight.
Dimensions.—
Span 8.14 m. (26 ft. 8 in.).
Length 5.45 m. (17 ft. 10½ in.).
Height 1.65 m. (5 ft. 5 in.).
Weights and Loadings.—
Weight empty 270 kg. (594 lb.).
Fuel and oil 38.5 kg. (85 lb.).
Crew (2) with parachutes 166 kg. (365 lb.).
Baggage 10 kg. (22 lb.).
Weight loaded 485 kg. (1,067 lb.).
Wing loading 48 kg./m.² (9.84 lb./sq. ft.).
Power loading 7.4 kg./h.p. (16.28 lb./h.p.)
Performance.—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 170 km.h. (105.5 m.p.h.).
Landing speed 75 km.h. (46.5 m.p.h.).
Initial rate of climb 180 m./min. (590 ft./min.).
Climb 360 m. (1,180 ft.) 2 min. 10 sec.
Service ceiling 4,000 m. (13,120 ft.).
T.O. distance to 20 m. (66 ft.) 370 m. (405 yds.).
Landing distance from 20 m. (66 ft.) 343 m. (375 yds.).



The C.A.B. Supercab (90 h.p. Continental C90 engine).

THE C.A.B. YG-30 SUPERCAB.

Type.—Two-seat light monoplane.
Wings.—Low-wing cantilever monoplane. Wing section NACA 23015 at root, tapering to NACA 33010 at tip. Aspect ratio 6.5. Dihedral 2° 30′. Incidence 3° 30′ at root, 1° at tip. All-wood structure. Slotted flaps inboard of slotted ailerons. Gross wing area 10.30 m.² (110.8 sq. ft.).
Fuselage.—All-wood plywood-covered structure.
Tail Unit.—Cantilever monoplane type. Fin integral with fuselage. Wood frames with plywood covered fin and tailplane and fabric-covered rudder and elevators. Ground-adjustable tab in rudder. Span of tail 2.88 m. (9 ft. 5 in.).
Landing Gear.—Tail-wheel type with retractable main wheels and fixed and steerable tail-wheel. Oleo-pneumatic shock-absorbers. Manual retraction. Mechanical wheel brakes, to be replaced by hydraulic brakes on production aircraft. Tracks 2.65 m. (8 ft. 8 in.).
Power Plant.—One 90 h.p. Continental C90 four-cylinder horizontally-opposed air-cooled engine. Two-blade fixed-pitch airscrew. Fuel capacity 70 litres (15.4 Imp. gallons).
Accommodation.—Enclosed cockpit seating two side-by-side on cross bench with dual controls. Front portion of canopy hinged

along base of windscreen and opens forward for access to and exit from cabin. Small baggage compartment behind seats.

DIMENSIONS.—
Span 8.20 m. (26 ft. 10 in.).
Length 5.50 m. (18 ft.).
Height 1.65 m. (5 ft. 5 in.).

WEIGHTS AND LOADINGS.—
Weight empty 400 kg. (880 lb.).
Weight loaded 613 kg. (1,348 lb.).
Wing loading 59.5 kg./m.² (12.19 lb./sq. ft.).
Power loading 6.8 kg./h.p. (14.9 lb./h.p.).

PERFORMANCE.—
Max. speed 275 km.h. (170 m.p.h.).
Cruising speed 235 km.h. (146 m.p.h.).
Initial rate of climb 234 m./min. (767 ft./min.).
Service ceiling 5,000 m. (16,400 ft.).
T.O. distance to 20 m. (66 ft.) 340 m. (372 yds.).
Landing distance from 20 m. (66 ft.) 300 m. (328 yds.).

DASSAULT

The Dassault M.D.450 Ouragan Single-seat Fighter (Hispano-Suiza Nene turbojet engine).

AVIONS MARCEL DASSAULT.

HEAD OFFICE: 46, AVENUE KLÉBER, PARIS (16e).

WORKS: SAINT CLOUD (SEINE-ET-OISE), ARGENTEUIL (SEINE-ET-OISE), BOULOGNE (SEINE), MERIGNAC (GIRONDE), TALENCE (GIRONDE) AND CASABLANCA (MAROC).

President: M. Marcel Dassault.

Director-General: M. Le Reverend.

Technical Director General: M. Henri Deplante.

Secretary-General: M. Germain Bloch.

Avions Marcel Dassault, formerly the Société des Avions Marcel Bloch, is engaged in the development and production of military aircraft.

The Company's principal current productions are the M.D. 452 Mystère II, the Mystère IV A, and the Super Mystère B2.

The M.D. 450 Ouragan was in production for the French Air Force from 1951. The order for 350 was completed in 1953. In addition, the Indian Government took delivery of 91 M.D. 450's for the Indian Air Force.

The Mystère II is in production for the French Air Force and the Mystère IV A is the subject of a large "off shore" order placed by the U.S. Government under the N.A.T.O. joint aircraft programme. It has also been ordered in quantity by the French Government. The Super Mystère B2 is already in production for the French Government.

Series production of these aircraft is being undertaken under a widespread sub-contracting programme, with the final assembly and flight testing being handled by Dassault. The total employment of the Dassault factories is only 4,500 while some 30,000 employees of other concerns all over France are engaged in the production of Dassault parts and sub-assemblies.

In 1953 Avions Marcel Dassault acquired the manufacturing licence of the Viper turbojet engine from Armstrong Siddeley Motors, Ltd.

Avions Marcel Dassault is also engaged in the development and manufacture of both electric and hydraulic quick-feathering and reversing airscrews. An electronic department is engaged in studying radar problems.

THE DASSAULT M.D.550.

The M.D. 550, which made its maiden flight on June 25, 1955, is a twin-engined delta-wing fighter which was designed to conform to a French Air Ministry specification for a light fighter. It is powered by two Dassault MD. 30 Viper (Armstrong Siddeley licence) turbojet engines.

No other details of the M.D. 550 were available for publication at the time of closing for press.

THE DASSAULT M.D.450 OURAGAN (HURRICANE).

The M.D.450 was the first French jet-propelled fighter to be ordered in quantity by the French Air Force and its evolution established a notable record in speed of design and construction. The design, to an official interceptor fighter specification, was begun in December, 1947, the official order for three prototypes was given on July 1, 1948, and the first prototype flew for the first time on February 28, 1949.

After very successful tests a pre-production order for twenty-five was placed and the first aircraft of this series flew at the end of November, 1950. The first production Ouragan flew for the first time in December, 1951.

Subsequently a total of 350 Ouragans was built for the French Air Force.

The Indian Government also took delivery of 91 M.D. 450's for the Indian Air Force. The Indian aircraft carry the name Toofani, which is Hindustani for Ouragan or Hurricane.

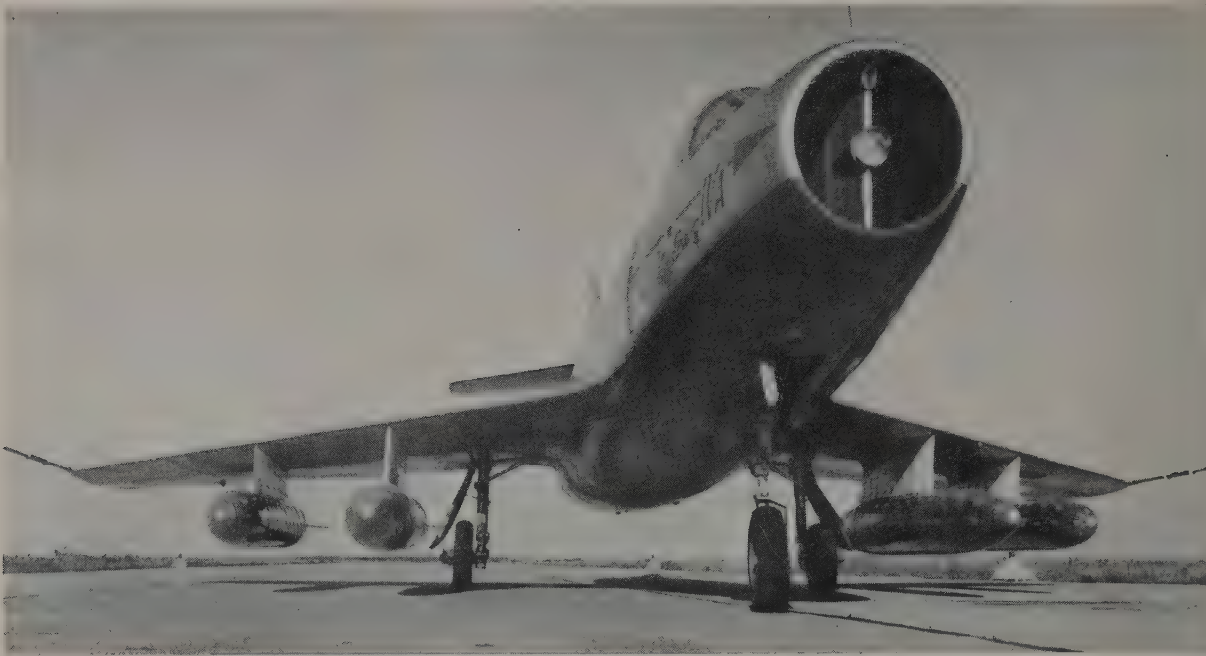
A full descriptive specification of the M.D. 450 has appeared in previous editions of this Annual.

THE DASSAULT M.D. 452 MYSTÈRE II.

The M.D.452 is a swept-wing version of the M.D. 450. The first of three Mystère I prototypes, powered with an Hispano-Suiza Nene engine, made its first flight on February 23, 1951. The other two Mystère I prototypes, the first of which flew on April 5, 1952, were powered by Hispano Suiza Tay engines.

A pre-production series of seventeen Mystère II's was ordered in April, 1951. The first two were Mystère II A's with Hispano-Suiza Tay 250 engines; the

The Dassault M.D. 452 Mystère II Swept-wing Fighter (Hispano-Suiza Tay turbojet engine).



The Dassault Mystère IV A with two auxiliary fuel tanks and two Napalm tanks.

next three were Mystère II B's with Tay 250 engines but with the armament changed from four 20 mm. to two 30 mm. cannon; while the last twelve were Mystère II C's with various versions of the SNECMA Atar 101 engine. The last two II C's were fitted with Atar 101F engines with afterburning.

The third pre-series Mystère II powered by an Hispano-Suiza Tay engine and fully armed with four 20 mm. cannon, exceeded Mach 1 on October 28, 1952, the first French aircraft to do so. It was flown by an American pilot and exceeded the speed of sound during comparative diving trials with a North American F-86 Sabre at Melun-Villaroche.

In April, 1953 the French Government placed a production order for 150 Mystère II C's to be powered by the SNECMA Atar 101D engine. The first production IIC flew in June, 1954.

The following description refers to the Mystère II C.

TYPE.—Single-seat Interceptor Fighter.

WINGS.—Low-wing cantilever monoplane. Symmetrical laminar-flow wing section. Thickness/chord ratio 9°. Sweepback 30° at 25% chord, 33° at leading-edge. Incidence at root 1°, at tip – 0° 34′. Dihedral 1° 30′. Two-spar all-metal structure. Split flaps between ailerons and fuselage. Gross wing area 30.3 m.² (326 sq. ft.).

FUSELAGE.—Circular-section all-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Fin sweepback 44° at 25% of chord. Rudder in two sections divided by horizontal surfaces. Tailplane has 5° dihedral at 32° sweepback at 25% of chord. Tailplane incidence adjustable from + 1° 40′ to – 2° 50′. Span of tail 3.84 m. (12 ft. 6 in.).

LANDING GEAR.—Messier hydraulically-operated retractable nose-wheel type. Main wheels raised inward, nose-wheel forward. Wheelbase 3.93 m. (12 ft. 10 in.). Track 2.20 m. (7 ft. 2½ in.).

POWER PLANT.—One SNECMA Atar 101 D2 axial-flow turbojet engine (3,000 kg. = 6,600 lb. s.t.). Nose air entry. Adjustable jet exit. Fuel in fuselage and wings outboard of landing-gear, plus pylon-mounted tanks.

ACCOMMODATION.—Pressurised cockpit with armoured windscreen and sliding jettisonable canopy. SNCASO ejector-seat.

ARMAMENT.—Two 30 mm. cannon in fuselage (150 r.p.g. each). Gyro gun-sight. Radar range-finding equipment. Camera recorder and cinema-gun.

DIMENSIONS.—
Span (clean) 11.62 m. (38 ft. 1 in.).
Span (over tip-tanks) 13.05 m. (42 ft. 9 in.).
Length 11.74 m. (38 ft. 6 in.).
Height 4.26 m. (13 ft. 11 in.).

WEIGHTS AND LOADINGS.—
Weight empty 5,225 kg. (11,495 lb.).
Weight loaded 7,460 kg. (16,412 lb.).
Wing loading 246 kg./m.² (50.4 lb./sq. ft.).

PERFORMANCE.—
Max. speed at S/L. 1,060 km.h. (658 m.p.h.).
Max. speed at 12,000 m. (39,360 ft.) 935 km.h. (581 m.p.h.).
Landing speed 205 km.h. (127 m.p.h.).
Initial rate of climb 2,220 m./min. (7,280 ft./min.).
Rate of climb at 12,000 m. (39,360 ft.) 660 m./min. (2,164 ft./min.).
Endurance 1.3 hours.
Take-off distance to clear 15 m. (50 ft.) 1,300 m. (1,420 yds.).
Landing distance from 15 m. (50 ft.) 1,250 m. (1,370 yds.).

THE DASSAULT MYSTÈRE IV A.

Although generally similar in general outline to the Mystère II, the IV A is a completely new aircraft. Its principal characteristics are given in the specification below.

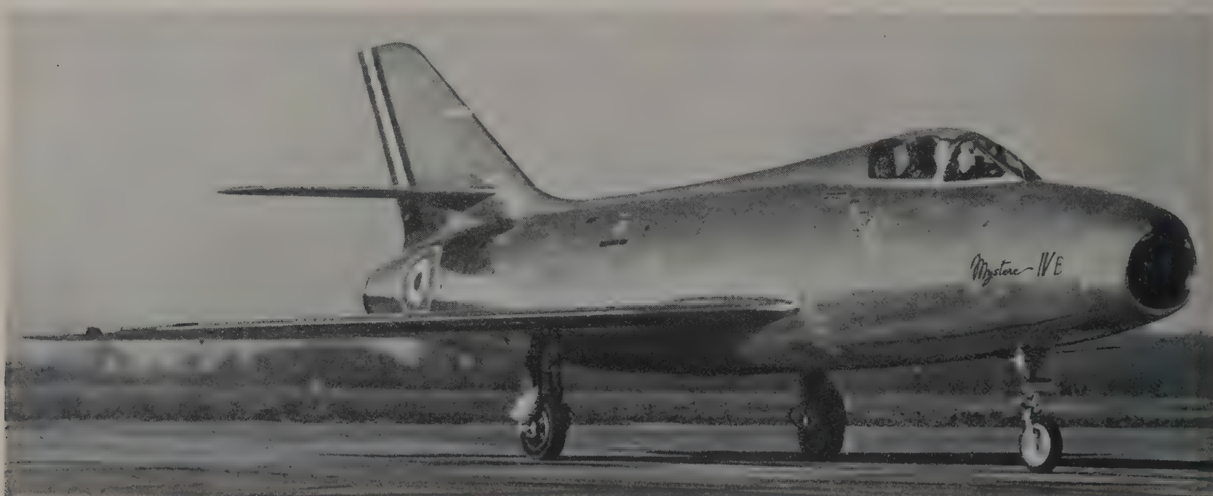
An "off-shore" order for 225 Mystère IV A's has been placed by the U.S.A.F., followed by an order of 100 for the French Air Force.

The first IV A prototype flew on September 28, 1952, and the first production aircraft was delivered in June, 1954.

TYPE. Single-seat Interceptor or Ground Attack Fighter.

WINGS.—Low-wing cantilever monoplane. Symmetrical laminar-flow wing section. Thickness/chord ratio 7.5%. Sweepback 40° 57′ at leading-edge, 38° at 25% of chord. Dihedral — 1° 30′. All-metal structure. Split flaps between ailerons and fuselage. Gross wing area 32 m.² (344.3 sq. ft.).

FUSELAGE.—All-metal structure.



The Dassault Mystère IV B Interceptor Fighter (Rolls-Royce Avon turbojet engine).

The prototype Dassault Mystère IV N Two-seat Night or All-weather Fighter (Rolls-Royce Avon turbojet engine).

Tail Unit.—Cantilever monoplane type. Generally similar to that of Mystère II except rudder is in one piece and above horizontal surface only All-flying tail with hydraulic servo-controls.
Landing Gear.—Messier hydraulically-operated retractable nose-wheel type. Track 3.25 m. (10 ft. 8 in.).
Power Plant.—One Hispano-Suiza Verdon centrifugal-flow turbojet engine (3,500 kg. =7,000 lb. s.t.). Main fuel in wings and fuselage. Auxiliary fuel in two external tanks carried beneath wings inboard of armament attachments on Alkan explosive releases. Total internal fuel 2,600 litres (572 Imp. gallons), total external fuel 1,250 litres (275 Imp. gallons).
Accommodation.—Pressurised cockpit with electrically operated sliding canopy. SNCASO ejector seat.
Armament.—Two 30 mm. cannon (150 r.p.g. each) in lower forward fuselage. Matra automatic rocket magazine containing 55 air-to-air rockets in fuselage aft of cannon installation. Attachment points under wings, with Alkan explosive releases, for two 227 kg. (500 lb.) or 454 kg. (1,000 lb.) bombs, or two 480-litre (106 Imp. gallon) Napalm containers, or two Matra rocket containers (19 air-to-air rockets each), or two groups of six air-to-ground rocket projectiles.
Dimensions.—
Span 11.12 m. (36 ft. 5½ in.).
Length 12.85 m. (42 ft. 1½ in.).
Height 4.40 m. (14 ft. 5 in.).
Weights.—
Weight empty 5,680 kg. (12,496 lb.).
Weight loaded 7,400 kg. (16,280 lb.).
Performance.—
Max. speed at S/L. 1,120 km.h. (695 m.p.h.).
Max. speed at operational altitude 990 km.h. (615 m.p.h.).

THE DASSAULT MYSTÈRE IV B.

The Mystère IV B differs from the IV A in the design of the front and rear fuselage and in power-plant. In the IV B the air inlet duct goes under the pilot's cockpit instead of dividing to pass on either side. Because of the re-alignment of the nose air inlet duct, the nose-wheel unit now retracts backwards, with the wheel turning through 90 degrees to lie flat beneath the air duct when fully retracted. The nose inlet aperture is similar to that of the North American F-86 Sabre with upper lip containing radar telemeter. The rear fuselage is longer to accommodate an afterburner.

The prototype IV B, powered by a Rolls-Royce Avon RA.7R with afterburner, first flew on December 16, 1953, and on February 24, 1954, this aircraft exceeded Mach. 1 in level flight.

Dimensions.—
Same as for Mystère IV A except:
Length 13.40 m. (43 ft. 11½ in.).
Weights and Performance.—
No data available.

THE DASSAULT MYSTÈRE IV N.

The Mystère IV N, which flew for the first time on July 19, 1954, is a two-seat night or all-weather interceptor fighter version of the IV B. The principal difference between these two aircraft lies in the forward fuselage which, in the IV N, accommodates a cockpit for pilot and radar operator seated in tandem and is fitted with a nose radome and a re-designed air inlet similar to that found on the North American F-86D Sabre.

Armament consists of two fuselage-mounted 30 mm. cannon with electronic tracking and firing equipment, and rocket carriers in the fuselage and beneath the wings for a total of 128 air-to-air rocket projectiles.

The prototype Mystère IV N is powered by a Rolls-Royce Avon RA.7R engine with afterburner but provision is also made, as in the IV B, for fitting the SNECMA Atar 101G engine.

Dimensions.—
Same as the IV B except:
Length 14.80 m. (48 ft. 6 in.).
Weights and Performance.—
No data available.

THE DASSAULT SUPER MYSTÈRE.

The Super Mystère is similar in general design to the Mystère IV B but has a thinner more sharply swept wing, an improved air inlet and better cockpit visibility.

The prototype Super Mystère B1, fitted with a Rolls-Royce Avon RA.7 engine with afterburner, first flew on March 2, 1955, and was flown at Mach. 1 in level flight on its fourth flight on the following day.

A production order has been placed by the French Government for 200 Super Mystère B2's, this version being powered by a SNECMA Atar 101G engine (4,200 kg.=9,240 lb. s.t.).

No further details of the Super Mystère are available for publication.

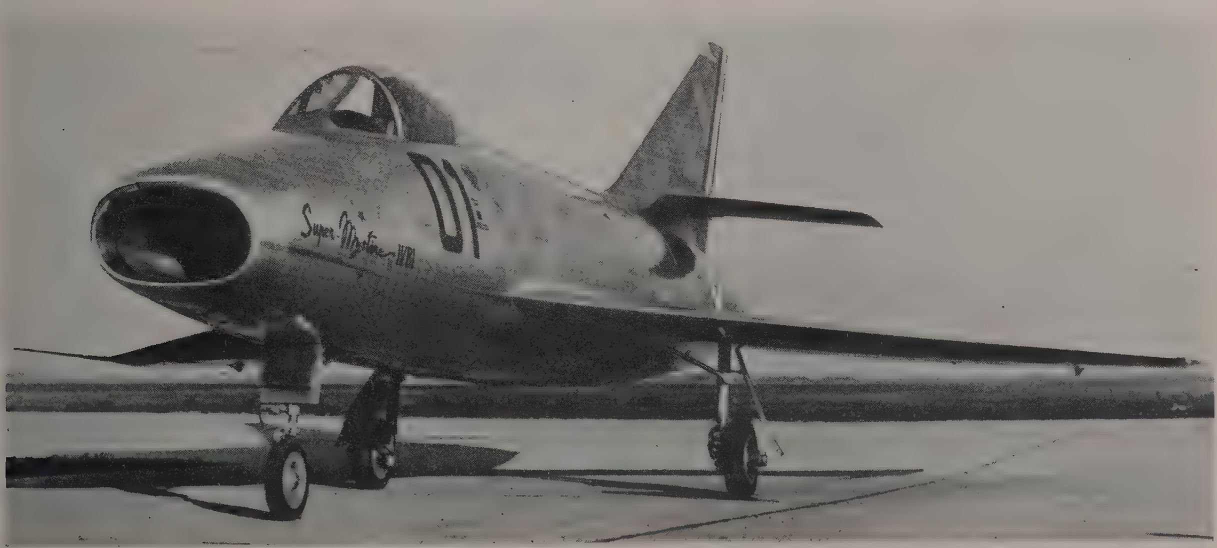
THE DASSAULT MYSTÈRE XXVI.

The Mystère XXVI is a twin-engined swept-wing light-weight fighter which conforms to a N.A.T.O. specification for a tactical fighter.

Three prototypes, to be powered by the Bristol Orpheus turbojet engine, have been ordered by N.A.T.O.

A carrier-borne version of the Mystère XXVI has also been evolved for the French Navy. This version would be powered by two Dassault M.D. 30 Viper turbojet engines.

No further details of the Mystère XXVI were available for publication at the time of closing for press.



The prototype Dassault Super Mystère B1 (Rolls-Royce Avon turbojet engine).

DRUINE

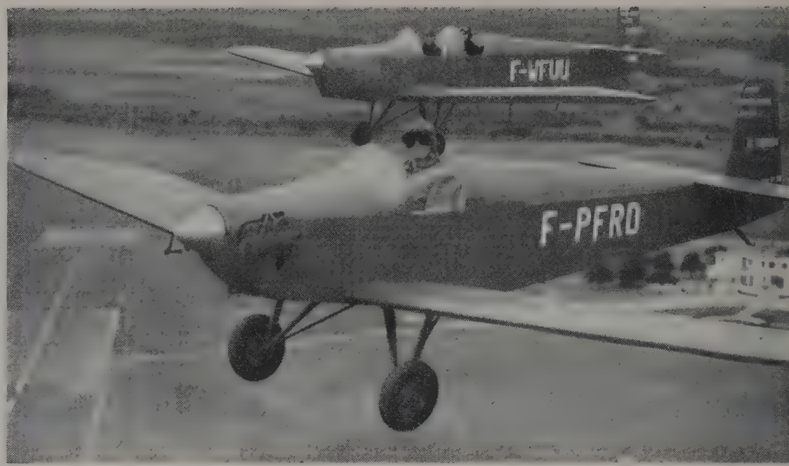
AVIONS ROGER DRUINE.

Address : 20, Avenue du Général Clavery, Paris (16e).

M. Roger Druine, who designed, built and flew his first aircraft at the age of seventeen, specialises in the design of aircraft which are suitable for amateur construction. His two most popular products are the Turbulent single-seat monoplane and the Turbi, a two-seat version of the Turbulent.

Both the Turbulent and Turbi are available in constructional kit form.

In the United Kingdom the Popular Flying Association which has been delegated by the A.R.B. to administer the new simplified procedure for the classification of ultra-light aircraft, has acquired the rights for both the Turbulent and Turbi, and is marketing sets of plans and instructions for amateur construction.



The Druine Turbulent and Turbi Light Monoplanes.

THE DRUINE D.31 TURBULENT.

The Turbulent is a conventional low-wing cantilever monoplane of wood and fabric construction which was designed primarily for the amateur constructor. It has met with considerable success and many have been built by clubs and private individuals. It was a club-built Turbulent which M. Roger Milcent, of the Aéro Club de Cognac, flew from Cognac to Casablanca. a distance of 1,000 miles without incident, in 1954.

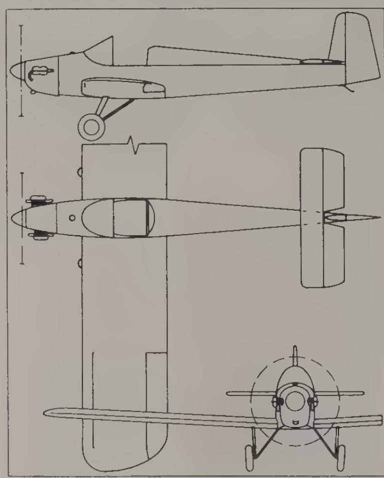
Type.—Single-seat light monoplane.

Wings.—Low-wing cantilever monoplane. NACA 23.012 wing section. Aspect ratio 5.4. Chord 1.20 m. (3 ft. 11 in.). Dihedral 4°. Incidence 3° 30′. Two-spar wood structure. D-type plywood leading-edge. Fabric covering aft of front spar. Built-in leading-edge slot on outer 45% of half span. Slotted ailerons have wood frames and fabric covering. Aileron area (total) 0.86 m.² (9.25 sq. ft.). Gross wing area 7.50 m.² (80.70 sq. ft.).

Fuselage.—Rectangular four-longeron structure with domed deck. Deck and sides covered with fabric bottom with plywood.

Tail Unit.—Cantilever monoplane type. All-wood frames, fin and tailplane covered with plywood, elevators and rudder with fabric. Areas : fin 0.12 m.² (1.29 sq. ft.), rudder 0.38 m.² (4.08 sq. ft.), tailplane 0.55 m.² (5.91 sq. ft.), elevators 0.50 m.² (5.38 sq. ft.). Span of tail 2.0 m. (6 ft. 7 in.).

Landing Gear.—Fixed divided type. Rubber-in compression-springing. Mechanical motorcycle type brakes. Small orientable tail-wheel. Track 1.25 m. (4 ft. 1 in.).



The Druine D.31 Turbulent.

Power Plant.—One 28 h.p. modified Volkswagen flat-four air-cooled engine. Two-blade fixed-pitch wood airscrew. One fuel tank (32 litres = 70 Imp. gallons) in fuselage in front of cockpit.

Accommodation.—Single open cockpit over trailing-edge of wing.

Dimensions.—
- Span 6.85 m. (22 ft. 5½ in.).
- Length 5.30 m. (17 ft. 4½ in.).
- Height 1.52 m. (4 ft. 11 in.).

Weights.
- Weight empty 155 kg. (341 lb.).
- Weight loaded 260 kg. (572 lb.).

Performance.—
- Max. speed at S/L. 140 km.h. (87 m.p.h.).
- Cruising speed 120 km.h. (74.5 m.p.h.).
- Landing speed 45 km.h. (28 m.p.h.).
- Initial rate of climb 150 m./min. (492 ft./min.).
- Climb to 1,000 m. (3,280 ft.) 9 min.
- Endurance 2.5 hours.
- Take-off run 160 m. (145 yds.).

The Druine Turbulent (28 h.p. Volkswagen engine).

THE DRUINE D.5 TURBI.

The Turbi is a two-seat development of the Turbulent. The prototype was designed for and fitted with the 45 h.p. Beaussier engine which is largely built up of components of the 11 h.p. Citroën automobile engine. More recently the design has been adapted to take the 65 h.p. Continental A65 flat-four or Walter Mikron four-cylinder inverted engines.

Type.—Two-seat light monoplane.

Wings.—Low-wing cantilever monoplane. NACA 23012 wing section. Structure as for Turbulent. Gross wing area 12.9 m.² (139 sq. ft.).

Fuselage.—Rectangular four-longeron all-wood structure. Rear decking covered with fabric.

Tail Unit.—Cantilever monoplane type. Fin built integral with fuselage. Non-adjustable tailplane. Fixed surfaces plywood-covered, movable surfaces fabric-covered.

Landing Gear.—Fixed tail wheel type. Spring shock-absorbers. Tail-skid.

Power Plant.—One 45 h.p. Beaussier 4 B02 four-cylinder inverted air-cooled engine. Merville two-blade fixed-pitch airscrew. Alternative power-plants may be the 65 h.p. Continental A65 or Walter Mikron engines. Fuel tank in fuselage decking in front of front cockpit.

Accommodation.—Tandem open cockpits.

Dimensions.—
- Span 8.70 m. (28 ft. 6 in.).
- Length 6.86 m. (22 ft. 6 in.).
- Wing area 13.50 m.² (145.2 sq. ft.).

Weights.—
- Weight empty 280 kg. (610 lb.).
- Weight loaded 495 kg. (1,090 lb.).

Performance.—
- Max. speed 155 km.h. (96 m.p.h.).
- Cruising speed 120 km.h. (74.5 m.p.h.).
- Landing speed 55 km.h. (34 m.p.h.).
- Initial rate of climb 150 m./min. (492 ft./min.).
- Range 640 km. (400 miles).
- Take-off run 160 m. (175 yds.).

THE DRUINE CONDOR.

The Condor has been designed primarily for factory production and incorporates many refinements in design and construction not found in the previously described Turbulent and Turbi. A simplified version will however be made available for amateur construction.

The Condor is or will be available in the following versions :—

D60. Prototype only. Fitted with 60 h.p. C.N.A. D4 (Italian) flat-four engine.

D61. First production version. Powered by 65 h.p. Continental A65 flat-four engine.

D62. Same as D.61 but fitted with 90 h.p. Continental C90 engine.

D610. Similar to D61 but modified to make it suitable for amateur construction.

D.620. Similar to D62. but fitted with trailing-edge flaps and VHF radio.

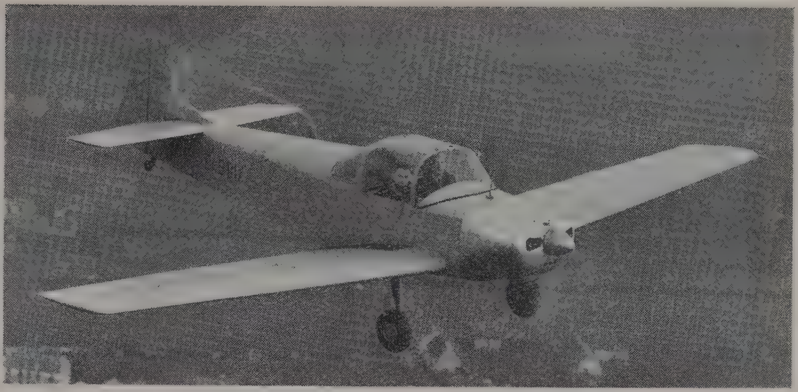
TYPE.—Two-seat light monoplane.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 6.8. Incidence 5° at root, 3° at tip. Dihedral (upper surface) 4° 30′. Wood structure with one main spar at 30% of chord and one auxiliary spar. Leading-edge covered with plywood, remainder with fabric, with a final overall protective covering of fabric. Slotted differentially-controlled ailerons. Trailing-edge flaps on D.620. Total area of ailerons 1.12 m.² (12.0 sq. ft.). Gross wing area 12.50 m.² (134.5 sq. ft.).

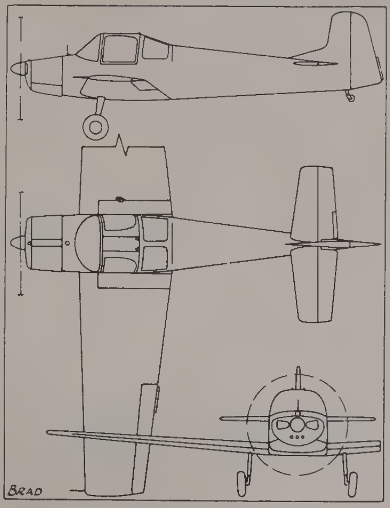
FUSELAGE.—All-wood structure with plywood skin and overall protective covering of fabric.

TAIL UNIT.—Cantilever monoplane type. Single-piece tailplane plywood-covered, with overall covering of fabric. Fin of similar construction is integral with fuselage. Wood-framed fabric-covered rudder and elevators. Areas : fin 0.32 m.² (3.4 sq. ft.), rudder 0.50 m.² (5.38 sq. ft.), tailplane 1.34 m.² (14.4 sq. ft.), elevators 0.72 m.² (7.74 sq. ft.). Span of tail 2.80 m. (9 ft. 2 in.).

LANDING GEAR.—Fixed tail-wheel type. Cantilever shock struts with rubber-in-compression springing. Mechanical wheel-brakes. Tail-wheel with steel spring suspension and rubber cord self centering. Track 1.75 m. (5 ft. 9 in.).



The Druine D.60 Condor (60 h.p. C.N.A. D4 engine).



The Druine D.60 Condor.

POWER PLANT.—One 60 h.p. C.N.A. D4 (D.60 prototype) or one 65 h.p. (D.61) or 90 h.p. (D.62) Continental four-cylinder horizontally-opposed air-cooled engine. Fuel tank in fuselage behind fireproof bulkhead.

ACCOMMODATION.—Enclosed cockpit seating two side-by-side. Cabin superstructure of steel tube with single-piece windscreen and Plexiglas windows in doors, which are hinged to open upwards. Two large Plexiglas panels in cabin rear fairing. Baggage space behind seats.

DIMENSIONS.—
Span 9.20 m. (30 ft. 2 in.).
Length 6.55 m. (21 ft. 6 in.).
Height (tail down) 1.54 m. (5 ft.).

WEIGHTS AND LOADINGS (D.61).—
Weight empty 301.5 kg. (663 lb.).
Pilot and passenger 155 kg. (341 lb.).
Fuel and oil 43.5 kg. (96 lb.).
Weight loaded 500 kg. (1,100 lb.).
Wing loading 40 kg./m.² (8.2 lb./sq. ft.).
Power loading 7.6 kg./m.² (16.5 lb./h.p.).

PERFORMANCE (D.61—65 h.p. Continental).—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Ceiling 4,200 m. (13,780 ft.).
Range 650 km. (400 miles).

PERFORMANCE (D.62—90 h.p. Continental).—
Max. speed 220 km.h. (136 m.p.h.).
Cruising speed 195-200 km.h. (121-124 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Ceiling 5,600 m. (18,370 ft.).
Range 700 km. (435 miles).

FARMAN

SOCIÉTÉ ANONYME DES USINES FARMAN.

HEAD OFFICE : 149, RUE DE SILLY, BOULOGNE-BILLANCOURT (SEINE).

WORKS : 168, RUE DE BILLANCOURT AND 10, RUE PAUL-BERT, BOULOGNE-BILLANCOURT (SEINE).

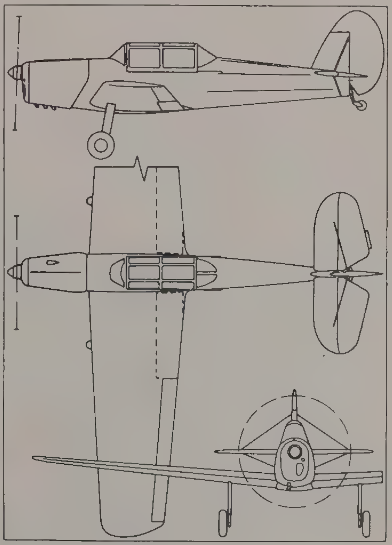
AERODROME : TOUSSUS - LE - NOBLE, NEAR VERSAILLES (SEINE-ET-OISE).

The original Farman company was formed by Henri Farman, one of the pioneers of French aviation, in 1908. Maurice Farman opened a works a little later. In 1912 the two brothers combined to form the company Avions H. et M. Farman.

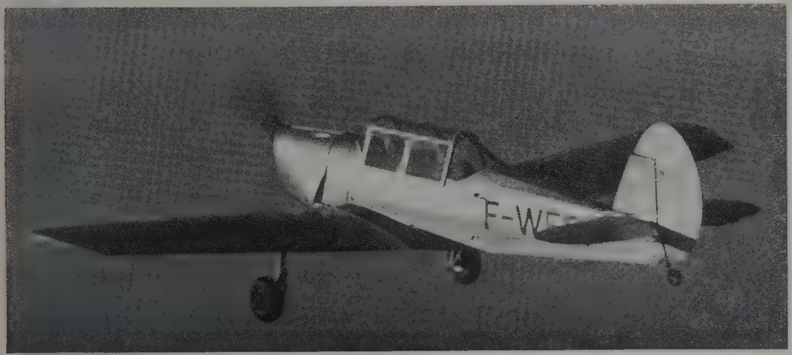
When, in 1936, the Popular Front Government introduced the Law for the Nationalisation of Military Industries all of Farman's military aircraft design and production activities were incorporated into the Société Nationale de Constructions Aéronautiques du Centre, leaving only a comparatively small proportion of the company's affairs under private control. It is from this remnant of the original company that the present concern is derived.

In 1939 Farman acquired a licence to build the Stampe S.V.4 trainer and large orders for this aircraft were placed with the company by the French Government. Only a few were completed before the fall of France. After the war the S.V.4 manufacturing rights were transferred to the Société Nationale de Constructions Aéronautiques du Nord but Farman retained the licence.

The Société Farman, with the collaboration of M. Stampe, has now produced a two-seat monoplane trainer which incorporates many of the components of the S.V.4, including the fuselage, tail-unit and power-plant. This aircraft, the Monitor I, flew for the first time on July 11, 1952.



The Farman Monitor I.



The Farman Monitor I (140 h.p. SNECMA Renault 4 Pei engine).

THE FARMAN MONITOR I.

TYPE.—Two-seat Trainer.

WINGS.—Low-wing cantilever monoplane. Centre-section, integral with fuselage, is a steel-tube structure. Outer wings have two spruce and plywood spars with plywood covering in between, and a plywood D leading-edge. Fabric covering aft of rear spar. Differential ailerons are statically and dynamically balanced. Split flaps

between ailerons and fuselage. Gross wing area 14 m.² (150.6 sq. ft.).

FUSELAGE.—Welded steel-tube structure covered with fabric.

TAIL UNIT.—Braced monoplane type. All surfaces are metal-framed and fabric-covered.

LANDING GEAR.—Fixed tail-wheel type. Cantilever main shock-absorber legs with rubber-in-compression springing. Wheel brakes. Tail wheel has helical sprung suspension.

POWER PLANT.—One 140 h.p. SNECMA Renault 4 Pei four-cylinder in-line inverted air-cooled engine. Any engine weighing about 200 kg. (440 lb.) and of from 140 to 190 h.p. can be fitted. Two fuel tanks (60 litres = 13.2 Imp. gallons each), one in each wing root. Two further tanks of similar capacity can be installed if desired.

ACCOMMODATION.—Tandem cockpits beneath continuous canopy. Canopy can be jettisoned in an emergency. Dual controls and instrumentation. Amber screening available for simulated night or blind flying training. Seats take seat-type parachutes.

DIMENSIONS.—
Span 9.44 m. (30 ft. 11 in.).
Length 6.80 m. (22 ft. 3½ in.).
Height 2.825 m. (9 ft. 3 in.).

WEIGHTS.—
Weight empty 560 kg. (1,232 lb.).
Weight loaded 820 kg. (1,804 lb.).

PERFORMANCE.—
Max. speed at S/L. 210 km.h. (130.4 m.p.h.).
Min. speed without flaps 84 km.h. (52 m.p.h.).
Min. speed with flaps 72 km.h. (44.7 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 4 min. 30 sec.
Absolute ceiling 5,500 m. (18,040 ft.).
Endurance 3 hours.

THE FARMAN MONITOR II.

The Monitor II, which won the 1953 competition for primary trainers meeting the requirements of the S.A.L.S. (now S.F.A.S.A.), is a development of the Monitor I. The wings are of metal construction with metal covering forward of the spar and the power-plant is a 220 h.p. Salmson-Argus eight-cylinder inverted Vee air-cooled engine.

The Monitor II flew for the first time on August 5, 1955.

DIMENSIONS.—
Span 9.94 m. (30 ft. 11 in.).
Length 7.28 m. (22 ft. 10 in.).
Height 2.20 m. (7 ft. 2½ in.).

WEIGHTS.—
Weight loaded 802 kg. (1,765 lb.).

PERFORMANCE.—
Max. speed 270 km.h. (168 m.p.h.).
Cruising speed 240 km.h. (149 m.p.h.).
Min. speed 75 km.h. (46.5 m.p.h.).
Duration 3 hours.

THE FARMAN MONITOR III.

The Monitor III is similar to the Monitor I except that it is fitted with a 170 h.p. SNECMA Regnier 4 L02 engine in place of the 140 h.p. SNECMA Renault 4 Pei engine.

The prototype Monitor III made its first flight on June 15, 1954.

PERFORMANCE.—
Max. speed at S/L. 225 km.h. (140 m.p.h.).
Min. speed without flaps 84 km.h. (52 m.p.h.).
Min. speed with flaps 72 km.h. (44.7 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 3 min. 30 sec.
Absolute ceiling 6,300 m. (20,665 ft.).

FOUGA

ÉTABLISSEMENTS FOUGA ET CIE.

HEAD OFFICE AND WORKS: BÉZIERS (HÉRAULT).

AIRCRAFT DEPARTMENT, WORKS AND AERODROME: AIRE-SUR-ADOUR (LANDES).

Director General: Henri Froustey.

Director of Aircraft Department: Pierre Mauboussin.

Technical Director: Robert Castello.

Director of Production: Paul Quoix.

The Établissements Fouga has operated an Aircraft Department since 1936.

The works at Aire-sur-Adour, covering an area of 14,000 m.² (150,640 sq. ft.), is situated alongside an aerodrome which the company has built with the assistance of the local municipality and the State.

The activities of the Aircraft Department of Fouga et Cie include both the design and construction of aircraft and gliders of original design and the repair and overhaul of aircraft for the French Air Force.

The latest product of the company is the C.M. 170R Magister twin-jet fighter trainer which has been ordered by the French Air Force. The first production order is for a series of 100.

Several new projects based on the C.M.170 were exhibited at the 1955 Salon de l'Aéronautique in model form. Brief details of these are given hereafter.

THE FOUGA C.M.170R MAGISTER.

The C.M.170R is a light two-seat twin-jet trainer which is in production for the French Air Force. The contract for three prototypes was signed on June 27, 1951, and the first of these flew for the first time on July 23, 1952. A pre-production order for ten aircraft was placed in June, 1953 and the first aircraft of this order made its maiden flight on July 7, 1954. An order for the series production of 100 aircraft was signed on January 13, 1954, and the first deliveries were due to be made in the latter half of 1955.

The C.M.170R prototypes underwent numerous evaluations by twenty specialised teams representing nine different countries, and suggestions and improvements put forward as the result of these trials are incorporated in the production aircraft. In consequence of these evaluations and the modifications and improvements resulting therefrom, a recommendation by the Military Agency for Standardisation, London, to standardise on the C.M.170R for basic and intermediate training in N.A.T.O. countries was made in September, 1954.

TYPE.—Light twin-jet two-seat trainer suitable for basic, intermediate and specialised training.

WINGS.—Mid-wing cantilever monoplane. NACA 64 Series wing section, thickness/chord ratio varying from 19% at root to 12% at tip. Aspect ratio 7.4. Chord 2.18 m. (7 ft. 2 in.) at root, 0.87 m. (2 ft. 10 in.) at tip. Taper ratio 0.40. Leading-edge sweepback 13°, trailing-edge sweepback nil. Single-spar structure with aluminium-alloy stressed skin. Hydraulically-operated all-metal slotted high-lift flaps of area-increasing type. Automatic tabs in ailerons. Retractable air brakes in upper and lower surfaces. Trailing-edge fences between air brakes and ailerons. Total flap area 2.13 m.² (22.92 sq. ft.). Total aileron area 1.02 m.² (10.97 sq. ft.). Gross wing area 17.30 m.² (186.1 sq. ft.).

FUSELAGE.—Oval all-metal semi-monocoque stressed-skin structure.

TAIL UNIT.—Butterfly type, the two tapered surfaces forming an inner angle of 110°. All-metal single-spar structure. Statically and aerodynamically balanced elevators. Projected areas horizontal 3.71 m.² (40 sq. ft.), vertical 2.60 m.² (28 sq. ft.). Span of tail 4.35 m. (14 ft. 4½ in.).

LANDING GEAR.—Messier retractable nose-wheel type. Hydraulic actuation. Steerable nose-wheel with anti-shimmy device. Hydraulic brakes on main wheels. Wheel-base 4.49 m. (14 ft. 9 in.). Track 3.80 m. (12 ft. 6¾ in.).

POWER PLANT.—Two Turbomeca Marboré II turbojet engines (400 kg. = 880 lb. s.t. each) partially buried in the sides of the fuselage aft of the wings and enclosed in symmetrical side protuberances which extend from the air inlets forward of the wing root leading-edges to the jet exits just forward of the tail-unit. The two engines are identical and interchangeable. Main fuel in two fuselage tanks. Total internal fuel capacity 700 litres (154 Imp. gallons). Two jettisonable wing-tip tanks (125 litres = 27.5 Imp. gallons each) may be fitted.

ACCOMMODATION.—Tandem cockpits under continuous transparent canopy. Hinged sections over cockpits open upward and rearward. Pupil in front seat, instructor in rear. All flying, brake and engine controls duplicated. Emergency landing-gear and air brake controls in front cockpit only.

The Fouga C.M.170R Magister (two Turbomeca Marboré II turbojet engines).

The Fouga C.M. 170R Magister (two Turbomeca Marboré II turbojet engines).

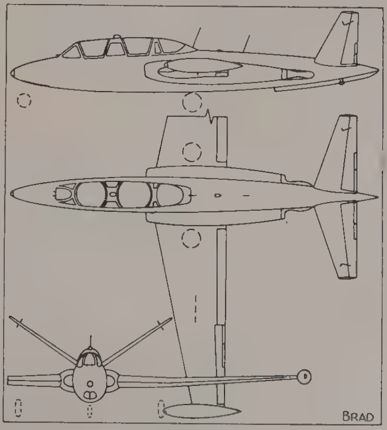
Cockpits are pressurised and air-conditioned by SEMCA turbo-refrigeration equipment driven by air bleeds from engine compressors. Individual oxygen supply with regulator in each cockpit. VHF radio, Lear-ADF 14B radio compass and interphone equipment. Blind-flying equipment.

ARMAMENT.—Two 7.5 mm. machine-guns (200 r.p.g.) in fuselage nose. Gyro gunsight in each cockpit, that in rear cockpit fitted with additional periscopic sight. Camera gun. Racks for two 25 kg. (55 lb.) air-to-ground rockets or for two 50 kg. (110 lb.) bombs may be fitted under each wing.

DIMENSIONS.—
- Span 11.3 m. (37 ft.).
- Length 10.0 m. (32 ft. 9½ in.).
- Height 2.8 m. (9 ft. 2 in.).

WEIGHTS.—
- Weight empty with fixed equipment 1,936 kg. (4,270 lb.).
- Crew (2) 170 kg. (370 lb.).
- Internal fuel and oil 600 kg. (1,320 lb.).
- Disposable load 830 kg. (1,830 lb.).
- Weight loaded 2,766 kg. (6,100 lb.).
- Max. permissible A.U.W. 3,205 kg. (7,055 lb.).

PERFORMANCE (at 2,850 kg.=6,280 lb. A.U.W.).—
- Max. speed at S/L 680 km.h. (423 m.p.h.).
- Max. speed at 9,150 m. (30,000 ft.) 715 km.h. (444 m.p.h.).
- Max. rate of climb at S/L 1,020 m./min. (3,350 ft./min.).
- Max. rate of climb at 9,150 m. (30,000 ft.) 300 m./min. (980 ft./min.).
- Climb to 9,150 m. (30,000 ft.) 16 min.



The Fouga C.M.170R Magister.

- Service ceiling 12,200 m. (40,000 ft.).
- Take-off run 550 m. (600 yds.).
- Take-off distance to clear 15.25 m. (50 ft.) 790 m. (865 yds.).
- Range at 9,150 m. (30,000 ft.) 910 km. (570 miles).
- Duration at 9,150 m. (30,000 ft.) 1 hour 55 min.

NOTE.—Above performance figures based on flight tests conducted by Centre d'Essais en Vol, Brétigny.

THE FOUGA C.M. 170M.

The C.M.170M is a naval trainer version of the C.M.170R. Two prototypes have been ordered by the French Navy and these will be assembled from production C.M.170R components but will incorporate some modifications to meet naval requirements. These include the fitting of a modified and strengthened Messier landing-gear, a special sliding canopy, catapult equipment and arrester gear.

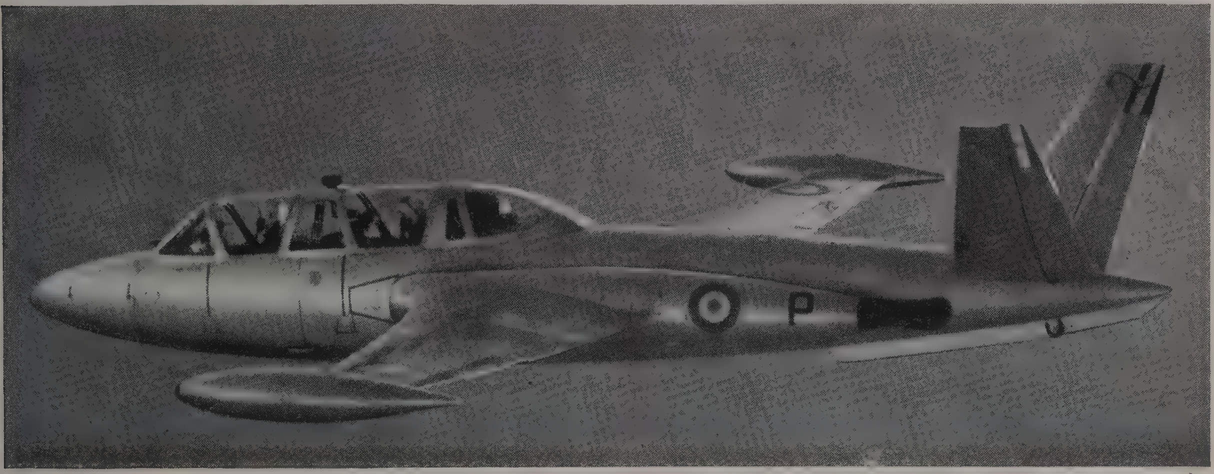
The production C.M.170M will be used as a deck-landing trainer and as a fighter trainer.

THE FOUGA C.M. 160.

The C.M.160 is a project for a lightened version of the C.M.170R suitable for operation from grass airfields and more economical to operate and maintain. The all-up weight of this version would be 2,675 kg. (5,885 lb.).

THE FOUGA C.M. 171 MAKALU.

The C.M.171 is a special version of the C.M.170R Magister which will serve as a flying test-bed for the new Turbomeca Gabizo turbojet engine (1,100 kg.=2,420 lb. s.t.). It will also be possible to instal two of the new Hispano-Suiza R-800 or SNECMA Vesta turbojets in the long nacelles which flank the sides of the fuselage as in the C.M.170. The C.M. 170 nacelles are, however, of much greater cross-section throughout their length.



The Fouga C.M. 170R Magister (two Turbomeca Marboré II turbojet engines).

HUREL-DUBOIS

SOCIÉTÉ DE CONSTRUCTION DES AVIONS HUREL-DUBOIS.

HEAD OFFICE AND WORKS: ROUTE DE VERRIÈRES, MEUDON-VILLACOUBLAY (SEINE-ET-OISE).

Avions Hurel-Dubois was formed to develop and put into practice the theories of M. Hurel regarding the advantages of using wings of high aspect ratio. Theoretical studies and wind-tunnel tests had shown that the induced drag of a monoplane braced by suitably designed lift struts is less than that of a cantilever monoplane of the same span and area. The use of struts permits the doubling or even trebling of the aspect ratio without increasing the weight of the wing, thereby allowing an increase in all-up weight and a considerable increase in useful load with the same power.

The company's first product, the H.D. 10 experimental monoplane, completed its trials with success and as a result the French Government ordered two twin-engined aircraft of the same general configuration. The first, the H.D. 31, made its first flight on January 27, 1953, and the second, the higher-powered H.D. 32, on December 29, 1953. A second H.D. 32 prototype made its maiden flight on February 11, 1955.

The H.D. 32 is now in production, the

The second prototype Hurel-Dubois H.D. 32 (two 1,200 h.p. Pratt & Whitney R-1830-92 engines).

S.N.C.A.S.E. being responsible for the manufacture of the major components and the final assembly. The first five H.D. 32's are expected to be completed by the end of 1956. Four H.D. 34's have been ordered by the Institut Géographique National and one prototype and two pre-production H.D. 35's have been ordered by the French Navy.

THE HUREL-DUBOIS H.D. 32.

TYPE.—Twin-engined Cargo-carrying monoplane.

WINGS.—High-wing braced monoplane. Aspect ratio 20.2. Wing in three sections, a rectangular centre-section and two tapering detachable outer sections. Centre-section chord 2.4 m. (7 ft. 10½ in.). Outer wings braced with single lift struts attached at their inner ends to small wing stubs which are also braced to the engine nacelles. Conventional ailerons with automatic tab in port aileron and controllable tab in starboard. Two spoiler surfaces with controls synchronised with that of ailerons. Double-slotted Fowler-type flaps. Entire wing of all-metal construction. Gross wing area 100 m.² (1,076 sq. ft.).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type with single fin and rudder. All-metal structure. Tailplane incidence adjustable on ground. Statically and aerodynamically balanced control surfaces. Elevator control surfaces in four parts, two inboard with full-span tabs, and two horn-balanced outboard with half-span tabs. Rudder in two parts, lower with full-span tab and horn-balanced upper with half-span tab. Total area of horizontal surfaces 24.5 m.² (264 sq. ft.), of vertical surfaces 14 m.² (152 sq. ft.).

LANDING GEAR.—Messier fixed tricycle type. All five wheels and low-pressure tyres are identical. Main shock-absorber struts in fairings between ends of small stub wings and engine nacelles. Paired main wheels enclosed in easily removable fairings which have ducted cooling for wheel brakes. Rear portions of shock strut fairings are hinged to serve as air-brakes. Steerable nose-wheel in readily removable fairing. Main wheel track 7 m. (22 ft. 11½ in.).

POWER PLANT.—Two 1,200 h.p. Pratt & Whitney R-1830-92 fourteen-cylinder radial air-cooled engines. Hamilton Standard constant-speed feathering airscrews. All fuel in wings. In each wing there are three 500 litre (110 Imp. gal.) and one 300 litre (66 Imp. gal.) tanks which supply engine through a 65 litre (14.4 Imp. gal.) auxiliary tank in engine nacelle. Cross-feed for each engine to be fed, if necessary, from opposite wing tanks.

ACCOMMODATION.—Provision for crew of three, pilot and co-pilot side-by-side with dual controls, and navigator/radio-operator behind the second pilot. Crew compartment heated and soundproofed. The unobstructed main cabin may carry either freight or passengers, or mixed load. Cabin dimensions: length 10 m. (32 ft. 9½ in.), width at floor 2.2 m. (7 ft. 2½ in.), height above floor 2 m. (6 ft. 7 in.), volume above floor 44 m.³ (1,554 cub. ft.), volume usable for freight over 50 m.³ (1,765 cub. ft.), height of cabin floor above ground 1.15 m. (3 ft. 9¼ in.). Main cargo loading door 2 m. × 2 m. (6 ft. 6 in. square) on starboard side aft of wing. A small door on same side forward of wing for crew and passengers. Freight holding-down rings in floor and sides of fuselage with necessary harness, etc. Up to 44 passengers may be carried.

DIMENSIONS.—
- Span 45.3 m. (148 ft. 7½ in.).
- Length 23.27 m. (76 ft. 4 in.).
- Height 8.73 m. (28 ft. 7½ in.).

WEIGHTS AND LOADINGS.—
- Weight empty 10,440 kg. (23,000 lb.).
- Payload (500 km. (310 mile) stage, without reserves) 5,980 kg. (13,170 lb.).
- Payload (1,000 km. (620 mile) stage, without reserves) 4,540 kg. (12,200 lb.).
- Gross take-off weight 18,000 kg. (39,600 lb.).
- Wing loading 179.5 kg./m.² (36.8 lb./sq. ft.).
- Power loading 7.49 kg./h.p. (16.5 lb./h.p.).

PERFORMANCE.—
- Cruising speed (57.1% rated power) 270 km.h. (169 m.p.h.).
- Stalling speed 118 km.h. (73.6 m.p.h.).
- Rate of climb at S/L. 250 m./min. (836 ft./min.).
- Rate of climb at S/L. one engine out 54 m./min. (177 ft./min.).
- Max. range 2,320 km. (1,450 miles).

THE HUREL-DUBOIS H.D. 321.

The H.D. 321 is similar to the H.D. 32, the only difference being that it is powered by two 1,525 h.p. Wright Cyclone 982 C9HE1 engines.

WEIGHTS AND LOADINGS.—
- Weight empty 10,440 kg. (23,000 lb.).
- Payload (500 km. (310 miles) stage, without reserves) 7,855 kg. (17,300 lb.).
- Payload (1,000 km. (620 mile) stage, without reserves) 7,400 kg. (16,300 lb.).
- Gross take-off weight 19,980 kg. (44,000 lb.).
- Wing loading 199.6 kg./m.² (40.9 lb./sq. ft.).
- Power loading 6.53 kg./h.p. (14.4 lb./h.p.).

PERFORMANCE.—
- Cruising speed (54.6% rated power) 275 km.h. (172 m.p.h.).
- Stalling speed 124 km.h. (77.7 m.p.h.).
- Rate of climb at S/L. 297 m./min. (975 ft./min.).
- Rate of climb at S/L. one engine out 69 m./min. (226 ft./min.).
- Max. range 2,370 km. (1,480 miles).

THE HUREL-DUBOIS H.D. 34.

The type number H.D. 34 has been given to a version of the H.D. 321 which has been specially developed as a photographic aircraft meeting the requirements of the Institut Géographique National.

It differs from the H.D. 321 by having a slightly longer front fuselage which accommodates a photographer/navigator's post in the extreme nose. The nose-wheel is mounted off-centre and is retractable.

In all other respects the two aircraft are similar. The performance of the H.D. 34 is the same as that guaranteed for the H.D. 321.

THE HUREL-DUBOIS H.D. 35.

The H.D. 35 is a long-range oversea reconnaissance and anti-submarine search and strike aircraft which has been developed from the H.D. 321 for the French Navy. It will be fitted with comprehensive electronic equipment and will be able to carry a wide range of offensive stores, including rockets, bombs and anti-submarine torpedoes.

Except for the specialised equipment the H.D. 35 is similar to and has practically the same general characteristics as the H.D. 321.

The first prototype Hurel-Dubois H.D. 32 (two 1,200 h.p. Pratt & Whitney R-1830-92 engines).

INDRAÉRO

SOCIETÉ INDRAÉRO.

Head Office and Works: Clion (Indre).

Technical Office and Factory: 17, Place Aristide-Briand, Déols (Indre).

Proprietors: MM. Chapeau and Blanchet.

MM. Chapeau and Blanchet have built many aircraft, in particular the Lévrier, which was exhibited at the 1946 Salon de l'Aéronautique.

Their latest product is the Aéro 110, a two-seat light biplane ten of which have been ordered by the S.A.L.S. (Service de l'Aviation Légère et Sportive).

The Aéro 110, illustrated and described herewith, is powered by a 45 h.p. Salmson radial engine.

There is also the Aéro 101, which is fitted with the 75 h.p. Minié flat-four engine and has some minor detail changes. The Aéro 101 first flew in 1953 and at the time of writing thirteen had been built.

The Aéro 101 (75 h.p. Minié engine).

THE AÉRO 110.

Type.—Two-seat Light Trainer.

Wings.—Single-bay staggered biplane. Upper and lower wings of equal span and chord. Wood monospar structure with fabric covering. I-type interplane struts. Ailerons on lower wings only. Gross wing area 14 m.² (150.6 sq. ft.).

Fuselage.—Steel tube frame work covered with fabric.

Tail Unit.—Braced monoplane type. Wood framework fabric covering.

Landing Gear.—Fixed type. Faired side vees and half-axles hinged to steel tube pyramid under the fuselage. Rubber-in-compression springing. Steerable tail-skid.

Power Plant.—One 45 h.p. Salmson 9ADB nine-cylinder radial air-cooled engine. Merville two-blade wood airscrew. Fuel tank in fuselage.

Accommodation.—Tandem open cockpits with dual controls. Hinged panel in upper wing for access to front cockpit.

Dimensions.—
- Span 7.60 m. (24 ft. 11 in.).
- Length 5.60 m. (18 ft. 4 in.).

Weights.—
- Weight empty 270 kg. (594 lb.).
- Weight loaded 455 kg. (1,000 lb.).

Performance.—
- Max. speed 130 km.h. (81 m.p.h.).
- Cruising speed 115 km.h. (71.4 m.p.h.).
- Initial rate of climb 126 m./min. (413 ft./min.).

The Aéro 110 (45 h.p. Salmson 9ADB engine).

THE AÉRO 101.

The Aéro 101 is similar in general arrangement to the previously-described aircraft except that it is powered by a 75 h.p. Minie flat-four engine. Modifications to the structure include the substitution of an all-wood fuselage for the fabric-covered steel-tube unit of the Aéro 110. It is also fitted with wheel brakes and a tail-wheel.

Performance.—
- Max. speed 175 km.h. (108.6 m.p.h.).
- Cruising speed 150 km.h. (93 m.p.h.).
- Initial rate of climb 192 m./min. (630 ft./min.).

JODEL

SOCIÉTÉ DES AVIONS JODEL.

Head Office and Works: Route de Seurre, Beaune (Côte-d'Or).

The Société des Avions Jodel was formed in March, 1946, by MM. Jean Delemontez and Edouard Joly, with the former acting as business and technical manager and the latter as test pilot.

Its first activities were concerned with the repair of gliders and light aircraft of the Service d'Aviation Légère et Sportive on behalf of the State.

In the meantime the company designed and built the D.9 single-seat light monoplane, the Bébé Jodel, which made its first flight in January, 1948. This aeroplane, which has received its airworthiness certificate with various power-plants, is intended for the amateur constructor.

As the result of official tests with the D.9, the French authorities placed an order for the development and construction of two prototypes of a two-seat model, the D.11, fitted with the 45 h.p. Salmson, and the D.111, fitted with the 75 h.p. Minié engine. A further model, the D.112, is fitted with a 65 h.p. Continental engine.

By the end of 1954, 366 kits of the single-seat Bébé Jodel and 310 kits of the two-seat models had been delivered to purchasers in all parts of the World.

THE JODEL D.9 BÉBÉ.

Type.—Single-seat Light monoplane.

Wings.—Low-wing cantilever monoplane. Single-spar one-piece wing with wide-span centre-section of constant chord and thickness and two tapering outer portions set at a coarse dihedral angle. Spar and ribs of spruce and plywood with fabric covering. Ailerons on outer portions. Gross wing area 9 m.² (96.8 sq. ft.).

Fuselage.—Rectangular spruce and plywood structure.

Tail Unit.—Cantilever monoplane type. No fin. Spruce and plywood frames with plywood-covered tailplane and fabric-covered rudder and elevators.

Landing Gear.—Divided type. Cantilever legs with rubber-in-compression springing. Leaf spring tail-skid.

Power Plant.—Either one 25 h.p. Poinsard or 34 h.p. A.B.C. Scorpion two-cylinder horizontally-opposed or 26 h.p. Volkswagen flat-four air-cooled engine. Fuel tank in fuselage.

Accommodation.—Single open cockpit.

Dimensions.—
- Span 7 m. (22 ft. 11 in.).
- Length (Poinsard) 5.35 m. (17 ft. 6 in.).
- Length (Scorpion) 5.40 m. (17 ft. 8½ in.).
- Length (Volkswagen) 5.45 m. (17 ft. 10½ in.).

Weights (Poinsard engine).—
- Weight empty 143 kg. (315 lb.).
- Disposable load 110 kg. (242 lb.).
- Weight loaded 253 kg. (557 lb.).

Weights (Scorpion engine).—
- Weight empty 160 kg. (352 lb.).
- Disposable load 110 kg. (242 lb.).
- Weight loaded 270 kg. (594 lb.).

Weights (Volkswagen engine).—
- Weight empty 162 kg. (356 lb.).
- Disposable load 110 kg. (242 lb.).
- Weight loaded 272 kg. (598 lb.).

Performance (Poinsard engine).—
- Max. speed 152 km.h. (94.4 m.p.h.).
- Cruising speed 115 km h. (71.4 m.p.h.).
- Landing speed 47 km h. (29 m.p.h.).
- Initial rate of climb 150 m./min. (492 ft./min.).

The Jodel D.9 Bébé Single-seat Light Monoplane.

Take-off run 55 m. (60 yds.).
Landing run 70 m. (76 yds.).
Range 400 km. (250 miles).

PERFORMANCE (Scorpion engine).—
Max. speed 170 km.h. (105.5 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Landing speed 50 km.h. (31 m.p.h.).
Initial rate of climb 240 m./min (787 ft./min.).
Take-off run 40 m. (44 yds.).
Landing run 70 m. (76 yds.).
Range 400 km. (250 miles).

PERFORMANCE (Volkswagen engine).—
Max. speed 150 km.h. (93 m.p.h.).
Cruising speed 130 km.h. (81 m.p.h.).
Landing speed 50 km.h. (31 m.p.h.).
Initial rate of climb 126 m./min. (412 ft./min.).
Take-off run 110 m. (120 yds.).
Landing run 60 m. (66 yds.).
Range 460 km. (286 miles).

THE JODEL D.11.

The D.11 is a two-seat dual-control version of the D.9. Except for increased overall dimensions, a wider fuselage and enclosed side-by-side cockpit, the D.11 conforms in layout and structure to the D.9. The D.11, which is fitted with a 45 h.p. Salmson radial engine, is also being marketed in kit form.

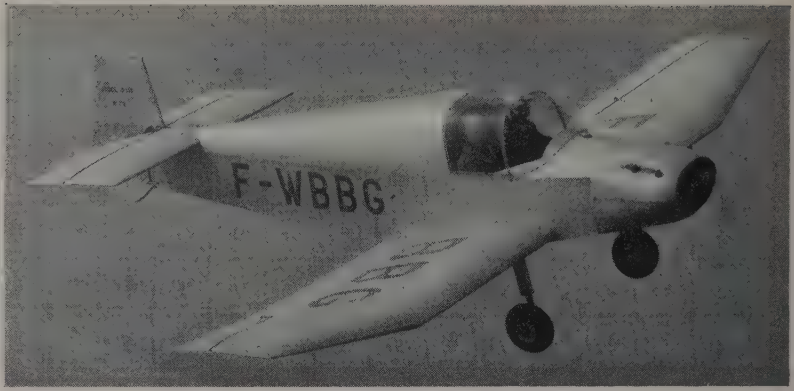
DIMENSIONS.—
Span 8.2 m. (26 ft. 10 in.).
Length 6.2 m. (20 ft. 4 in.).
Wing area 12.7 m.² (136.6 sq. ft.).

WEIGHTS.—
Weight empty 270 kg. (594 lb.).
Disposable load 215 kg. (473 lb.).
Weight loaded 485 kg. (1,067 lb.).

PERFORMANCE.—
Max. speed 170 km.h. (105.5 m.p.h.).
Cruising speed 155 km.h. (96 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Initial rate of climb 140 m./min. (460 ft./min.).
Take-off run (no wind) 160 m. (175 yds.).
Take-off to 20 m. (66 ft.) 360 m. (395 yds.).
Landing run 80 m. (85 yds.).
Range 600 km. (375 miles).

THE JODEL D.111.

The D.111 is identical to the D.11 except that it is fitted with a 75 h.p. Minié flat-four engine. A small series of the D.111 is under construction.



The Jodel D.111 (75 h.p. Minié engine).

DIMENSIONS.—
Same as D.11 except:
Length 6.28 m. (20 ft. 7 in.).

WEIGHTS.—
Weight empty 280 kg. (616 lb.).
Weight loaded 520 kg. (1,144 lb.).

PERFORMANCE.—
Max. speed 200 km.h. (124 m.p.h.).
Max. cruising speed 170 km.h. (105.5 m.p.h.).
Economic cruising speed 155 km.h. (96 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Rate of climb 220 m./min. (720 ft./min.).
Take-off run (no wind) 90 m. (98 yds.).
Take-off to 20 m. (66 ft.) 260 m. (284 yds.).
Landing run 90 m. (98 yds.).
Range 700 km. (435 miles).

THE JODEL D.112.

The D.112 is the D.11 fitted with a 65 h.p. Continental flat-four engine.

DIMENSIONS.—
Same as D.111.

WEIGHTS.—
Weight empty 270 kg. (594 lb.).
Weight loaded 490 kg. (1,078 lb.).

PERFORMANCE.—
Max. speed 180 km.h. (112 m.p.h.).
Max. cruising 170 km.h. (105.5 m.p.h.).
Economic cruising 150 km.h. (93 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Rate of climb 175 m./min. (575 ft./min.).
Take-off run (no wind) 120 m. (131 yds.).
Take-off to 20 m. (66 ft.) 300 m. (328 yds.).
Landing run 80 m. (85 yds.).
Range 600 km. (373 miles).

THE JODEL-WASSMER D.120.

The D.120, a de-luxe version of the D.112, is not intended for amateur production. It is being built in a small series by the Etablissements Wassmer, 13 rue Etienne-Dolet, Paris (20e).

Among the many refinements introduced in the D.120 are a redesigned canopy to provide better rearward view; full upholstery in the cabin; radio as standard equipment; spatted wheels, etc. The power-plant is a 90 h.p. Continental C90 flat-four, which gives the aircraft a greatly improved performance.

LEDUC

RENÉ LEDUC ET FILS.

HEAD OFFICE AND WORKS: 158, QUAI DE BEZONS, ARGENTEUIL (SEINE-ET-OISE).

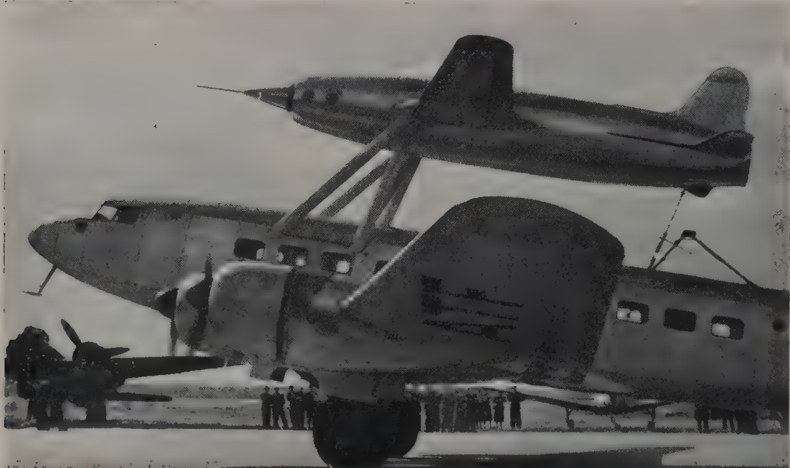
René Leduc has for many years concentrated on the development of the "athodyd" or ramjet type of power-plant for aircraft. As far back as 1935 he was successful in producing a small unit which developed a thrust of 4 kg. (8.8 lb.) at 300 m./sec. (985 ft./sec.).

His first complete ramjet-driven aircraft was the 0.10 monoplane. It was powered by a Leduc athodyd which developed a thrust of about 2,250 kg. (4,590 lb.) at 900 km.h. (560 m.p.h.) at sea level. The O.10 was first released as a glider from the top of a Languedoc 161 in October, 1947.

On April 21, 1949, the O.10 with a pilot was released from a Languedoc 161 at 3,050 m. (10,000 ft.) over Toulouse. It flew for 12 minutes and reached a speed of 680 km.h. (450 m.p.h.) on only half power. In a later flight, also on half power, a speed of over 800 km.h. (500 m.p.h.) was attained at a height of 11,000 m. (36,080 ft.), at which height the climbing speed was 2,440 m./min. (8,000 ft./min.).

Three prototypes, all of similar construction and having the same overall dimensions, were built. The first two were identical, but the third, the O.11, which was air-launched for the first time on February 8, 1951, was originally intended to be fitted with two Turbomeca Piméné turbojet engines, one at each wing-tip. These jets, which were at one time fitted but have now been removed, were intended to serve as stand-by power-units for use in the air or for landing. This third prototype also has a mechanically retractable landing-gear.

A larger prototype, the O.21, was completed in the Spring of 1953. It made its first flight from a carrier aircraft on May 16, 1953. Under construction is the O.22 which will be supersonic. Both the O.21 and O.22 are being developed to the order of the French Air Ministry.


The Leduc O.10 on its carrier aircraft, a Languedoc 161.

THE LEDUC O.10.

The Leduc O.10 was the first experimental piloted monoplane driven by a Leduc ram-jet or athodyd.

The ram-jet power-plant cannot operate before sufficient air velocity is introduced into the tube. The Leduc O.10 must, therefore, be taken into the air by a carrier aircraft and reach a speed of 320 km.h. (200 m.p.h.) before the fuel can be turned on and ignited.

TYPE.—Two-seat Experimental Ramjet Monoplane.

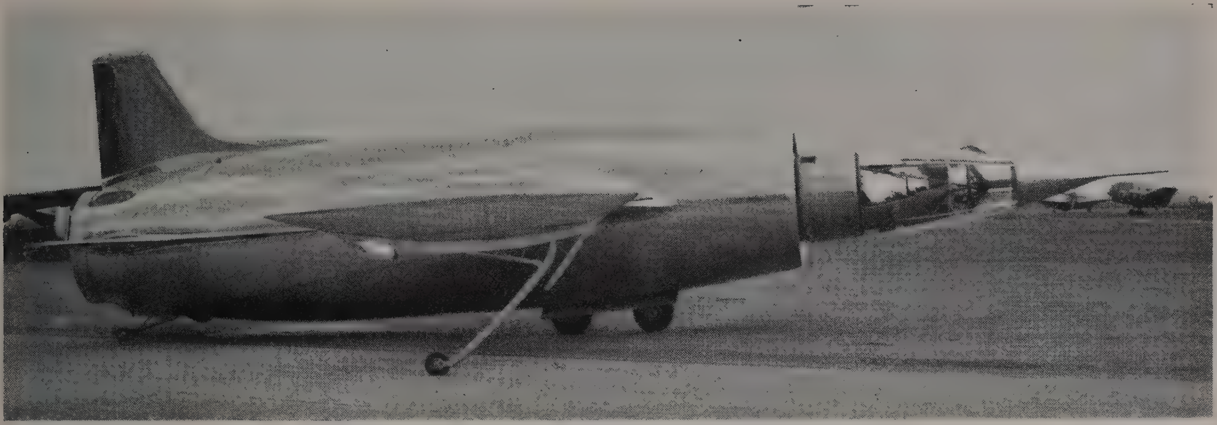
WINGS.—Cantilever mid-wing monoplane. All-metal structure. Central sealed two-spar box girder serving as integral fuel tank, passes through fuselage. Detachable leading-edge forward and slotted flaps and ailerons aft of box. Gross wing area 16 m.² (172 sq. ft.).

FUSELAGE.—Tubular open-ended fuselage duct is a double-skinned light alloy structure. Suspended in the forward end by cross wires is the pilot's compartment.

TAIL UNIT.—Cantilever monoplane type. Light alloy structure. Fin and halves of tailplane attached to fuselage duct by external fittings.

LANDING GEAR.—Retractable tail-wheel type. Wheels stowed in under-wing filets and when lowered turn through 45 degrees. Manual operation.

POWER PLANT.—Leduc "athodyd" or thermo-propulsive fuselage duct. Air enters annular opening surrounding pilot's cockpit, passes to centre of fuselage where it enters



The Leduc O.21 High-speed Research Ramjet Monoplane.

a series of five internal cylindrical ducts of increasing size, the leading-edge of each duct being ringed with fuel injectors, there being a total of 500 burners in all. The resultant mixture is ejected from the rear end of the fuselage as a high-velocity jet. Fuel feed by electrically-driven pump. Fuel (1,135 litres=250 Imp. gallons) carried in wing.

ACCOMMODATION.—Sealed compartment in front end of fuselage duct seats two in tandem. Perspex nose cone provides forward vision and corresponding circular windows in compartment and outer duct, two on each side, provide lateral vision. Two doors give access to seats. Air-conditioning and heating. Pilot's cockpit and forward portion of fuselage duct can be detached in emergency and lowered by parachute stowed above wing in after portion of compartment, which also encloses small Leduc auxiliary gas-turbine which drives generator.

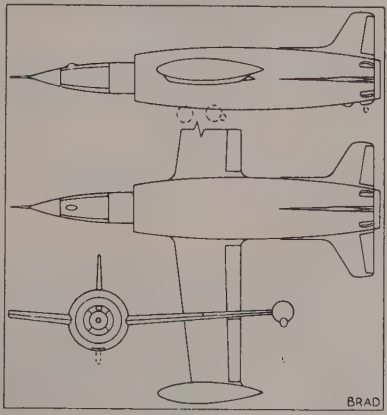
DIMENSIONS.—
Span 10.520 m. (34 ft. 6 in.).
Length 10.250 m. (33 ft. 7 in.).
Wing area 16 m.² (172.1 sq. ft.).

WEIGHT.—
Weight loaded 2,800 kg. (6,160 lb.).

THE LEDUC O.21.

The O.21, which made its first flight from a Languedoc carrier aircraft on May 16, 1953, is about one-third larger than the O.10 previously described, the maximum diameter of the athodyd duct being 2.44 m. (8 ft.). Two prototype O.21's are now flying.

The cockpit, which is pressurised and jettisonable, is in the form of a transparent cone completely clear of the front end of the fuselage duct to give 100 per cent. visibility for the pilot. Jacottet-Leduc servo controls are fitted.



The Leduc O.21.

The athodyd develops a maximum thrust of 7,500 kg. (16,500 lb.) at 1,000 km.h. (621 m.p.h.).

The landing-gear is of the tandem wheel type, with wing-tip stabilising skids.

The O.21 has a rate of climb of 200 m./sec. (656 ft./sec.) at 1,000 km.h. (621 m.p.h.) and has a powered duration of 15 minutes at 15,000 m. (49,200 ft.).

DIMENSIONS.—
Span 11.70 m. (38 ft. 4½ in.).
Length 12.50 m. (41 ft.).

WEIGHT LOADED.—
5,200 kg. (11,440 lb.).

THE LEDUC O.22.

The O.22, of which two prototypes are under construction, will be a supersonic interceptor development of the O.21. It will have an initial loaded weight of 6 tonnes (13,200 lb.), thirty per cent. of which will be fuel. The fuel will be carried in the wings and between the double walls of the fuselage duct. It is estimated that the fuel consumption will be under 2.5 kg./kg. s.t./hr. (2.5 lb./lb. s.t./hr.).

The low/mid-wing will have a 30° sweepback and the tail surfaces will also be swept. The landing-gear will be of the tricycle type, all wheels retracting into the fuselage shell, the main wheels turning through 45° and the nose-wheel through 90° in the process of retraction.

It is estimated that the O.22 will have a maximum speed of Mach. 2 and that the equivalent ground level thrust of the athodyd at that speed will be of the order of 60,000 kg. (132,000 lb.).

The O.22 will be able to take off under its own power with the aid of a SNECMA Atar turbojet engine which will be installed within the body of the athodyd.

No further details are available.

MAX HOLSTE

AVIONS MAX HOLSTE.

HEAD OFFICE: 17 RUE DE CHÂTEAUBRIAND, PARIS (VIIIe).

WORKS: 11 RUE GOSSET, RHEIMS.

President and General Director: Max Holste.

Avions Max Holste has produced several all-metal aircraft, of which the M.H. 52, M.H. 53 and M.H. 152 are the best-known. All have been described in previous issues of this Annual.

The latest product of the company is the M.H. 1521 Broussard, a slightly larger and more powerful version of the M.H. 152. A first series of twenty-four is being built, eighteen of which are destined for delivery to the French Army. Production is eventually expected to total 250 aircraft, of which 183 will be delivered to the French Army.

THE MAX HOLSTE M.H. 1521 BROUSSARD.

TYPE.—Six-seat General Utility monoplane.

WINGS.—High-wing rigidly-braced monoplane. NACA 44013 wing section. Aspect ratio 7.5. Chord 1.850 m. (6 ft.) constant. Dihedral 1°30′. Incidence 3°. All-duralumin structure. Central two-spar box with detachable leading-edge. Slotted flaps and ailerons hinged to rear spar. Ailerons arranged to droop 13° when flaps are lowered to 45° while still retaining their differential action. Each single bracing strut is a steel tube with dural sheet fairing. Gross wing area: 25.4 m.² (273.3 sq. ft.).

FUSELAGE.—Duralumin structure with stressed skin canopy.

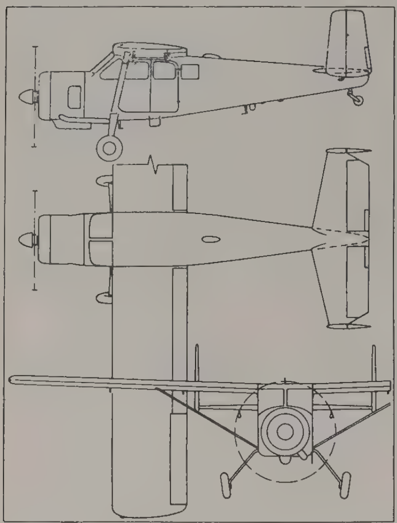
TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. Duralumin frames with metal-covered fixed surfaces and fabric-covered elevators and rudders. Controllable trim-tabs in both elevators and in port rudder.

LANDING GEAR.—Fixed tail-wheel type. Spring steel (Cessna licence) main legs. Orientable tail-wheel with self-centering device. ERAM oleo-pneumatic shock-absorber. Brakes on main wheels.

POWER PLANT.—One 450 h.p. Pratt & Whitney R-985 nine-cylinder radial air-cooled engine. Hamilton Standard 2.AD. 30 constant-speed airscrew. Fuel tanks in wing roots.

The Max Holste M.H. 1521 Broussard (450 h.p. Pratt & Whitney R-985 engine).

ACCOMMODATION.—Enclosed cabin seating six in three pairs, the front pair with dual controls. Large door in two parts on port side. As an ambulance can carry pilot, two stretcher cases one above other on starboard side and two sitting cases on port side. Dimensions of cabin: length 3.08 m. (10 ft. 1 in.), width 1.25 m. (4 ft. 1 in.), average height 1.35 m. (4 ft. 5 in.), volume 4.80 m.^{3} (169.4 cub. ft.).



The Max Holste M.H. 1521.

The Max Holste M.H.1521 Broussard (450 h.p. Pratt & Whitney R-985 engine).

DIMENSIONS.—
- Span 13.745 m. (45 ft. 1 in.).
- Length 8.60 m. (28 ft. 2 in.).
- Height 2.80 m. (9 ft. 2 in.).

WEIGHTS AND LOADINGS (Pilot and five passengers).—
- Weight empty, equipped 1,450 kg. (3,190 lb.).
- Pilot 75 kg. (165 lb.).
- Fuel and oil 325 kg. (715 lb.).
- Useful load 520 kg. (1,144 lb.).
- Weight loaded 2,450 kg. (5,390 lb.).
- Wing loading 96.5 kg./m.^{2} (19.78 lb./sq. ft.).
- Power loading 5.18 kg./h.p. (11.39 lb./h.p.).

PERFORMANCE.—
- Max. speed at S/L. 270 km.h. (168 m.p.h.).
- Cruising speed (50% power) at 1,500 m. (4,920 ft.) 230 km.h. (143 m.p.h.).
- Min. speed (flaps lowered) 75 km.h. (46.5 m.p.h.).
- Min. speed (flaps retracted) 90 km.h. (55.8 m.p.h.).
- Rate of climb at S/L. 360 m./min. (1,180 ft./min.).
- Range (with 500 kg. = 1,100 lb. commercial load) 1,200 km. (745 miles).
- Range (with 600 kg. = 1,320 lb. commercial load) 800 km. (500 miles).
- Take-off run 155 m. (170 yds.).
- Landing run 120 m. (131 yds.).

MAX PLAN

ADDRESS: 115, RUE BELIN, ARGENTEUIL (SEINE-ET-OISE).

M. Max Plan, chief of the supersonic tunnel at Meudon Bellevue, has designed and built a small racing aircraft. The S.A.L.S. loaned the 75 h.p. Minié engine which powered the aircraft for its early flights, but M. Plan intends to instal a 90 h.p. Continental C90 engine. The prototype Max Plan MP.204 made its first flight on June 5, 1952. Since then the aircraft has been fitted with a new engine cowling, an enlarged cockpit and other minor modifications. Thus modified the Minié-engined aircraft is known as the MP.214. With the Continental engine it will be known as the MP.215.

The Max Plan MP.214 (75 h.p. Minié engine).

THE MAX PLAN MP.214.

TYPE.—Single-seat Sports monoplane.

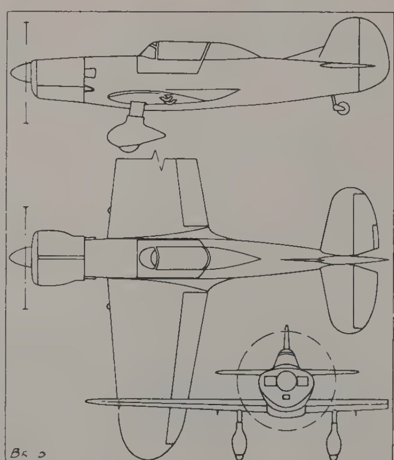
WINGS.—Low-wing cantilever monoplane. NACA 23012 wing section. Aspect ratio 5. Chord 1.50 m. (4 ft. 11 in.) at root, 0.75 m. (2 ft. 5½ in.) at tip. Dihedral and washout nil. Incidence +1°. Single-spar wood structure with plywood skin. Linkage of slotted ailerons permits their use as flaps. Maximum deflection 45°. Area of ailerons 1 m.^{2} (10.76 sq. ft.). Gross wing area 6 m.^{2} (64.58 sq. ft.).

FUSELAGE.—All-wood structure. Four longerons with balsa wood monocoque fairing.

TAIL UNIT.—Cantilever monoplane type. All wood construction. Movable surfaces are very light balsa wood coques. Areas: fin 0.60 m.^{2} (6.45 sq. ft.), rudder 0.40 m.^{2} (4.30 sq. ft.), tailplane 0.60 m.^{2} (6.45 sq. ft.), elevators (total) 1.20 m.^{2} (12.91 sq. ft.). Tailplane span 2 m. (6 ft. 7 in.).

LANDING GEAR.—Fixed tail-wheel type. Cantilever shock-absorber struts with rubber-in-compression springing. Light alloy fairings. Messier Fouga-type cable-operated brakes. Track 1.30 m. (4 ft. 3 in.).

POWER PLANT.—One 75 h.p. Minié 4 DC 32 four-cylinder horizontally-opposed air-cooled engine. Two-blade fixed-pitch air-screw. One internal fuel tank 70 litres (15.4 Imp. gallons) capacity. Provision for drop tank beneath fuselage. Maximum permissible fuel capacity 200 litres (44 Imp. gallons).



The Max Plan MP.214.

ACCOMMODATION.—Pilot's cockpit over wing. Canopy fitted after pilot is in cockpit.

DIMENSIONS.—
- Span 5.50 m. (18 ft.).
- Length 5.30 m. (17 ft. 6 in.).

WEIGHTS AND LOADINGS.—
- Normal loaded weight 360 kg. (792 lb.).
- Max. permissible weight (long-range) 500 kg. (1,100 lb.).
- Normal wing loading 60 kg./m.^{2} (12.30 lb./sq. ft.).
- Normal power loading 4.8 kg./h.p. (10.56 lb./h.p.).

PERFORMANCE.—
- Max. speed 270 km.h. (168 m.p.h.).
- Cruising speed 240-250 km.h. (149-155 m.p.h.).
- Min. speed (without flaps) 100 km.h. (62 m.p.h.).
- Min. speed (with flaps) 80 km.h. (50 m.p.h.).
- Initial rate of climb 180 m./min. (550 ft./min.).
- Endurance at full power 4 hours.

MORANE-SAULNIER

AEROPLANES MORANE-SAULNIER.

HEAD OFFICE: 3, RUE VOLTA, PUTEAUX (SEINE).

WORKS: PUTEAUX (SEINE), SURESNES (SEINE), ALENÇON (ORNE) AND OSSUN-LOUEY, NEAR TARBES (HAUTES-PYRENEES).

Commercial Director: M. Sollier.

The Morane-Saulnier Company was originally formed in 1911 and its parasol monoplane fighters were flown by the French Air Force and the Royal Flying Corps in the war of 1914-18. In the inter-war period Morane-Saulnier built many notable aircraft, mainly military trainers and single-seat fighters.

Since the war Morane-Saulnier has concentrated mainly on the design and production of trainers. Its latest types are the M.S. 733 three-seat basic trainer which is in series production for the French Air Force, and the M.S. 755 two-seat jet fighter trainer.

The company has developed from the M.S. 755 a four-seat light communications and liaison monoplane, known as the M.S. 760 Paris.

THE MORANE-SAULNIER M.S. 760 PARIS.

The M.S. 760 is a four-seat light communications development of the M.S. 755 described overleaf. The principal differences concern the cabin, which is arranged

The Morane-Saulnier M.S. 760 Paris (two Turbomeca Marboré II turbojet engines).

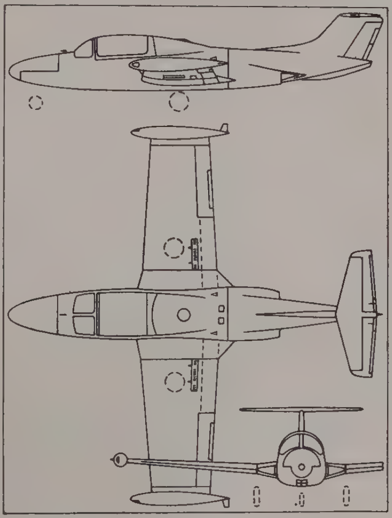
to seat four in two pairs, and the internal fuel capacity which is increased from 680 litres (150 Imp. gallons) to 975 litres (215 Imp. gallons). The wing-tip tanks hold 225 litres (49.5 Imp. gallons) each, the same as for the M.S. 755.

The M.S. 760 flew for the first time on July 29, 1954.

DIMENSIONS.—
Span (over tip tanks) 10.15 m. (33 ft. 3½ in.).
Length 10.03 m. (32 ft. 11 in.).
Height 2.60 m. (8 ft. 6½ in.).

WEIGHTS.—
Weight empty 1,910 kg. (4,205 lb.).
Weight loaded 3,400 kg. (7,480 lb.).

PERFORMANCE.—
Max. speed 650 km.h. (380 m.p.h.) at S/L.
Cruising speed 570 km.h. (350 m.p.h.) at 6,000 m. (19,680 ft.).
Initial rate of climb at S/L. 690 m./min. (2,264 ft./min.).
Climb to 7,000 m. (22,960 ft.) 18 min.
Service ceiling 10,000 m. (32,800 ft.).
Still-air range at 7,000 m. (22,960 ft.) 1,500 km. (930 miles).
Take-off run 750 m. (820 yds.).



The Morane-Saulnier M.S. 760 Paris.

THE MORANE-SAULNIER M.S. 755 FLEURET.

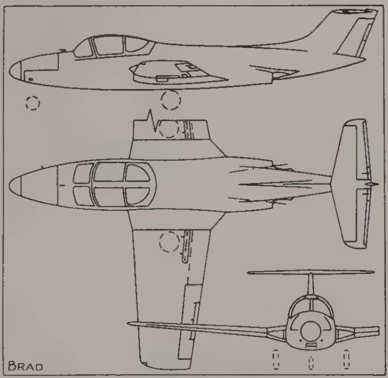
TYPE.—Two-seat Jet Fighter-Trainer.

WINGS.—Low mid-wing cantilever monoplane. Wing section NACA 64 A 1 (13.5) at root, (12) at tip. Aspect ratio 5.12. Chord 2.168 m. (7 ft. 1 in.) at root, 1.540 m. (5 ft. 1 in.) at tip. Dihedral 8°. Incidence 2°. All-metal structure. All-metal ailerons with static balance and spring tabs. Electrical-operated all-metal split flaps and air brakes, with emergency mechanical operation. Total area of flaps 1.54 m.² (16.57 sq. ft.). Total area of ailerons 2.30 m.² (24.75 sq. ft.). Gross wing area 18 m.² (193.68 sq. ft.).

FUSELAGE.—All-metal structure in four sections—nose section, pressurised cabin section, central engine section, and easily detachable tail-section.

TAIL UNIT.—Cantilever T-type tail. All-metal structure. Areas: fin 1.10 m.² (11.83 sq. ft.), rudder 0.53 m.² (5.70 sq. ft.), tailplane 1.57 m.² (16.89 sq. ft.), elevators (total) 1.28 m.² (13.77 sq. ft.). Tailplane span 3.40 m. (11 ft. 2 in.).

LANDING GEAR.—Retractable nose-wheel type. Electrical retraction, with emergency mechanical operation. ERAM oleo-pneumatic shock-absorbers. ERAM wheels and hydraulic brakes. Main wheel track 3.725 m. (12 ft. 2½ in.). Wheelbase 2.42 m. (7 ft. 11 in.).



The Morane-Saulnier M.S. 755 Fleuret.

POWER PLANT.—Two Turbomeca Marboré II turbojet engines (400 kg.=880 lb. s.t. each) mounted in the sides of the fuselage with air inlets in the wing roots. Rear fuselage quickly detachable to give access to engines. Main fuel tank (680 litres=150 Imp. gallons) in fuselage. Provision for two auxiliary wing-tip tanks (225 litres=49.5 Imp. gallons each). Oil capacity 20 litres (4.4 Imp. gallons).

ACCOMMODATION.—Pressurised and air-conditioned cabin seating two side-by-side. Sliding and jettisonable canopy. Emergency escape exit through trap in underside of fuselage. Blind-flying and night-flying equipment, VHF radio, radio and magnetic compasses, etc.

ARMAMENT.—Two 7.5 mm. machine-guns in nose of fuselage, ciné gun, racks for two 50 kg. (110 lb.) bombs or four 3.5 in. rockets beneath wings. Gyro gun-sight.

DIMENSIONS.—
Span 9.56 m. (31 ft. 4 in.).
Span (over tip tanks) 10.08 m. (33 ft. 0 in.).
Length 9.70 m. (31 ft. 10 in.).
Height 2.73 m. (8 ft. 11 in.).

WEIGHTS AND LOADING.—
Weight empty 1,905 kg. (4,190 lb.).
Normal loaded weight 2,650 kg. (5,830 lb.).
Max. permissible loaded weight 3,050 kg. (6,710 lb.).
Normal Wing loading 147.22 kg./m.² (30.18 lb./sq. ft.).

PERFORMANCE.—
Max. speed 720 km.h. (447 m.p.h.) at 6,000 m. (19,680 ft.).
Initial rate of climb 1,020 m./min. (3,346 ft./min.).
Service ceiling 12,000 m. (39,360 ft.).
Take-off run 400 m. (438 yds.).
Take-off distance to clear 15 m. (50 ft.) 735 m. (805 yds.).

THE MORANE-SAULNIER M.S. 733 ALCYON.

TYPE.—Three-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Wing section M.S. 1033 modified. Aspect ratio 5.8. Dihedral 12° on outer wings. All-duralumin structure. Slotted flaps. Ailerons on inset hinges. Total aileron area 2.03 m.² (21.8 sq. ft.). Total flap area

The Morane-Saulnier M.S. 755 Fleuret Jet Trainer (two Turbomeca Marboré II turbojet engines).

2.14 m.^{2} (23 sq. ft.). Gross wing area 21.9 m.^{2} (235.6 sq. ft.).

FUSELAGE.—All-duralumin structure. Two sides and bottom are electrically-welded jig-built units and are riveted together.

TAIL UNIT.—Cantilever monoplane type. All-duralumin structure assembled by riveting and spot welding. Areas: fin 0.756 m.^{2} (8.13 sq. ft.), rudder 1.163 m.^{2} (12.51 sq. ft.), elevators (total) 1.650 m.^{2} (17.75 sq. ft.), tailplane 1.806 m.^{2} (19.43 sq. ft.). Span of tail 3.68 m. (12 ft.).

LANDING GEAR.—Retractable main wheels, non-retractable tail-wheel. ERAM oleo-pneumatic shock-absorbers. Electric retraction, with emergency manual operation. ERAM hydraulic brakes on main wheels. Twin-contact tyre on tail-wheel. Track 2.306 m. (7 ft. 7 in.).

POWER PLANT.—One 230 h.p. Potez 6.D 00A six-cylinder in-line inverted air-cooled engine. Ratier type 2316 hydraulic variable-pitch airscrew 2.25 m. (7 ft. 4½ in.) in diameter. Fuel tank in fuselage. Total fuel capacity 245 litres (54 Imp. gallons). Oil capacity 16 litres (3.5 Imp. gallons).

ACCOMMODATION.—Enclosed cockpit seating three, two side-by-side with dual controls in front and one behind. Canopy in two independent halves, right and left, separated by a structural member to protect crew in a turn-over. The halves slide aft for access to cabin and are jettisonable in an emergency. 25G adjustable seats. Blind and night flying amber-screen equipment, VHF radio, radio compass, intercom., heating and ventilation.

DIMENSIONS.—
Span 11.29 m. (37 ft.).
Length (tail-up) 9.34 m. (30 ft. 7 in.).
Height (tail-up) 3.46 m. (11 ft. 4 in.).

WEIGHTS.—
Weight empty 1,262 kg. (2,780 lb.).
Disposable load 408 kg. (900 lb.).
Weight loaded 1,670 kg. (3,680 lb.).

PERFORMANCE.—
Max. speed at S/L. 260 km.h. (162 m.p.h.).
Cruising speed 230 km.h. (143 m.p.h.).
Rate of climb at S/L. 252 m./min. (825 ft./min.).
Time to 2,000 m. (6,560 ft.) 10 min.
Service ceiling 4,800 m. (15,750 ft.).
Cruising endurance at 1,000 m. (3,280 ft.) 4 hrs.
Take-off run 350 m. (383 yds.).

The following figures relate to the M.S. 735 which is fitted with a 305 h.p. Potez 6.D 30 supercharged engine.

WEIGHTS.—
Weight empty 1,292 kg. (2,850 lb.).
Weight loaded 1,700 kg. (3,750 lb.).

PERFORMANCE.—
Max. speed at S/L. 270 km.h. (168 m.p.h.).
Max. speed at 1,800 m. (5,900 ft.) 285 km.h. (177 m.p.h.).
Cruising speed at 1,800 m. (5,900 ft.) 250 km.h. (155 m.p.h.).
Rate of climb at S/L. 300 m./min. (985 ft./min.).
Service ceiling 6,500 m. (21,000 ft.).
Cruising endurance 3 hrs. 40 min.
Take-off run 290 m. (317 yds.).

Two views of the Morane-Saulnier M.S. 733 Alcyon Basic Trainer.

NORD

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU NORD (S.N.C.A.N.).

HEAD OFFICE: 12*bis* AVENUE BOSQUET, PARIS (7e).

DEVELOPMENT CENTRE: CHATILLON-SOUS-BAGNEUX (SEINE).

TEST CENTRE: LES GÂTINES.

WORKS: BOURGES (CHER), LES MUREAUX (SEINE-ET-OISE), MEAULTE (SOMME) AND LYON-VILLEURBANNE (RHÔNE).

President-Director-General: M. J. Piette.

General Secretary: M. J. Otier.

Chairman of the Technical Board: M. L. Coroller.

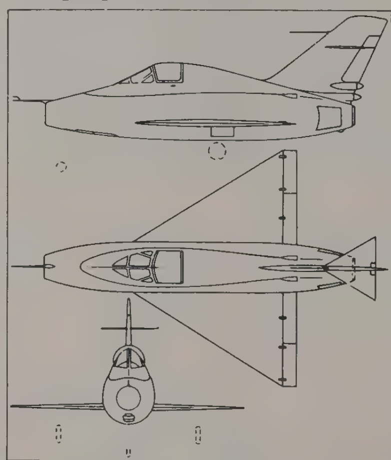
Chief Engineers in charge of various departments: MM. Buret, Calvy, Decker, Dupin, Galtier, Montlaur, Pierrat, Pichon, Stauff.

Commercial Director: M. Leconte.

The Société Nationale de Constructions Aéronautiques du Nord was formed in 1936 under the laws for the nationalisation of the Aircraft Industry. It grouped together the former Potez, C.A.M.S. and Les Mureaux companies and also took over certain factories belonging to the Breguet concern. M. Henry Potez was the first Administrator.

At the end of 1945 the Société Anonyme des Avions Caudron-Renault was incorporated in the S.N.C.A.N.

Following the liquidation of the S.N.C.A. du Centre in 1949, the Bourges factory of that society was integrated in the Nord group.



The Nord 1402 Gerfaut IA.

On January 1, 1953, the factory at Lyon-Villeurbanne which formerly belonged to the Arsenal de l'Aéronautique was taken over by the S.N.C.A.N.

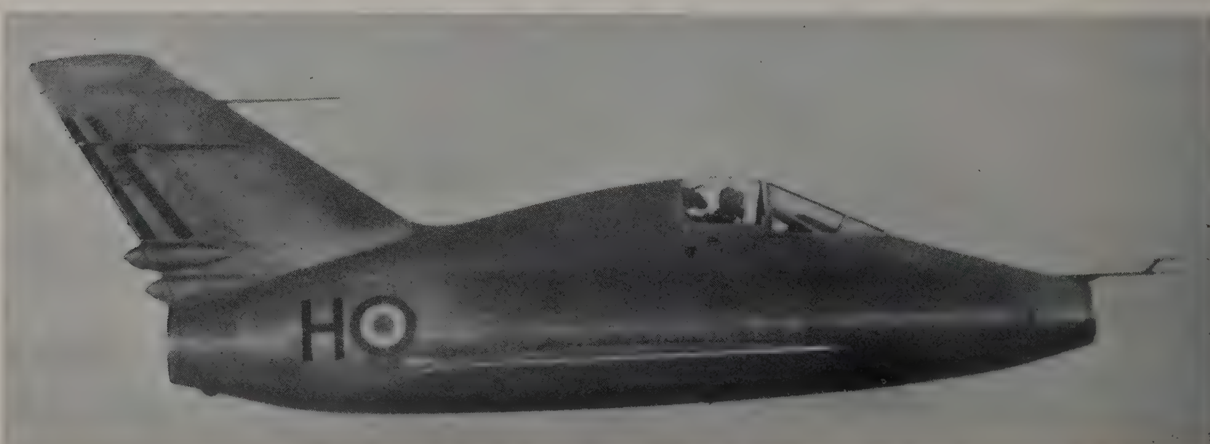
Towards the end of 1954, on the recommendation of the Air Secretary of the Ministry of Defence, the boards of directors of the Société Nationale de Constructions Aéronautiques des Nord and the Société Française d'Etudes et de Constructions de Matériels Aéronautiques Spéciaux (SFECMAS) agreed to merge their two companies under the common name of the former.

The new Nord organisation continues all the activities of the two former companies, the aim of the fusion being to concentrate technical, production and financial resources. The company covers a very wide field of activities in research and development and has extensive production facilities.

THE NORD (SFECMAS) 1402 GERFAUT.

The Gerfaut 1A was the first high-powered jet-powered delta-wing aircraft to fly in France. It made its maiden flight on January 15, 1954.

The Gerfaut wing has a leading-edge sweepback of about 60 degrees and a thickness ratio of less than 6 per cent. The high-mounted delta tailplane is of



The Nord 1402 Gerfaut IA (SNECMA Atar 101D turbojet engine).

the movable type without separate elevators.

The power-unit, a SNECMA Atar 101D turbojet, is mounted in the fuselage amidships with straight-through air inlet and jet exit pipes. The pilot's enclosed cockpit is situated above the air intake duct. All fuel and equipment is accommodated in the fuselage.

The tricycle landing-gear is of Messier design. The main wheels retract inwardly while the small nose-wheel turns through 90 degrees when retracting rearwards, to lie flush in the fuselage beneath the inlet duct.

Air brakes are mounted on either side of the rear fuselage just ahead of the jet exit. Two braking parachutes are fitted in containers at the base of the fin.

On August 3, 1954, the Gerfaut 1A exceeded Mach. 1 in level flight without the use of either afterburner or rocket power.

The Gerfaut 1B is fitted with a wing of larger area thus improving landing and take-off characteristics. The 1B exceeded the speed of sound in level flight on February 11, 1955. Its climb performance is similar to that of the 1A.

The Gerfaut II was, at the time of writing, under construction. It will be a light interceptor and will be fitted with a new type of armament. The Gerfaut II will be powered by an Atar 101G turbojet engine with after-burning.

The following are the principal characteristics of the Gerfaut 1A.

Dimensions.—
- Span 6.50 m. (21 ft. 4 in.).
- Length 9.90 m. (32 ft. 5½ in.).
- Height 4.175 m. (13 ft. 8 in.).
- Wing area 26 m.² (205 sq. ft.).

Weights.—
- Weight empty 2,900 kg. (6,380 lb.).
- Weight loaded 3,600 kg. (7,920 lb.).

Performance.—
- Max. speed Mach 1 at 11,000 m. (36,080 ft.)
- Initial rate of climb 7,625 m./min. (25,000 ft./min.).
- Ceiling 17,000 m. (55,760 ft.).

THE NORD 3201.

The 3201, the prototype of which flew for the first time on June 22, 1954, is a two-seat trainer destined for the training schools of the S.A.L.S. (now S.F.A.S.A.).

Type.—Two-seat Trainer.

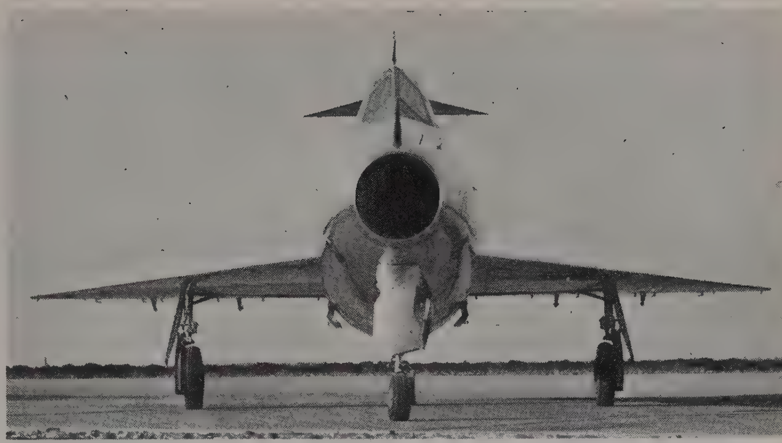
Wings.—Low-wing cantilever monoplane. Dihedral 3° 30′. One-piece metal monospar structure covered with fabric. Trailing-edge flaps inboard of ailerons. Gross wing area 16.50 m.² (177.5 sq. ft.).

Fuselage.—Welded steel tube structure covered with metal panels forward and fabric aft.

Tail Unit.—Cantilever monoplane type. Metal frames covered with fabric. Tailplane incidence adjustable in flight, fin adjustable on ground only. Automatic tabs in elevator and rudder.

Landing Gear.—Fixed type. Cantilever oleo-pneumatic shock-absorber legs. Wheel brakes. Steerable tail-wheel.

Power Plant.—Prototype powered by one 170 h.p. SNECMA 4 LO 2 four-cylinder in-line inverted air-cooled engine. Alternative power-units include the 240 h.p. Potez 6 D00 six-cylinder in-line, and the 260 h.p. Salmson 8.AS04 eight-cylinder vee inverted air-cooled engines.



The Nord 1402 Gerfaut 1A (SNECMA Atar 101D engine).

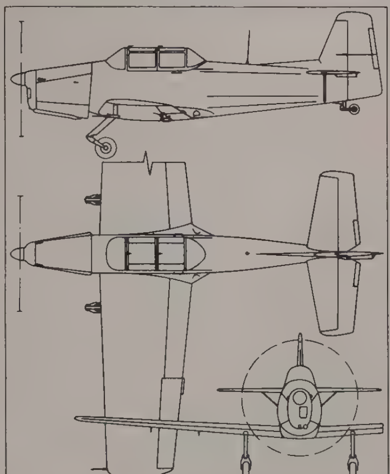
Accommodation.—Tandem seats, with instructor in rear cockpit, under two-piece sliding canopy. Seats are adjustable for height and take dorsal-type parachutes. Full electrical and VHF radio equipment.

Dimensions.—
- Span 9.80 m. (32 ft. 1½ in.).
- Length 7.99 m. (26 ft. 2½ in.).
- Height 3.120 m. (10 ft. 2¾ in.).

Weights (with 240 h.p. Potez 6 D00 engine).—
- Weight empty 824 kg. (1,813 lb.).
- Crew (2) 166 kg. (365 lb.).
- Fuel and oil 144 kg. (317 lb.).
- Weight loaded 1,134 kg. (2,495 lb.).

Performance.—
- Max. speed at S/L. 274 km.h. (150 m.p.h.).
- Min. speed 83 km.h. (51.5 m.p.h.).
- Take-off run 144 m. (157 yds.),

The Nord 3200 Trainer (250 h.p. Salmson 8AS04 engine).



The Nord 3201 Trainer.

The Nord 3201 Trainer (170 h.p. SNECMA Régnier 4L02 engine).

THE NORD 3200.

The 3200 is an aerobatic trainer or light executive or touring monoplane which differs from the 3201 mainly by being powered by a 250 h.p. Salmson 8AS 04 eight-cylinder inverted Vee air-cooled engine. The prototype 3200 made its first flight on September 10, 1954.

Weights and Loadings (Aerobatic category).—
- Weight empty 700 kg. (1,540 lb.).
- Fuel and oil 84 kg. (185 lb.).
- Weight loaded 950 kg. (2,090 lb.).
- Wing loading 57 kg./m.² (11.68 lb./sq. ft.).
- Power loading 5.55 kg./h.p. (12.21 lb./h.p.).

Weights and Loadings (Touring or executive aircraft). —
- Weight empty 790 kg. (1,738 lb.).
- Fuel and oil 154 kg. (339 lb.).
- Weight loaded 1,110 kg. (2,442 lb.).
- Wing loading 67.2 kg./m.² (13.77 lb./sq. ft.).
- Power loading 6.52 kg./h.p. (14.34 lb./h.p.).

Performance.—
- Max. speed 230 km.h. (143 m.p.h.).
- Cruising speed 200 km.h. (124 m.p.h.).
- Min. speed 85 km.h. (52.7 m p.h.).
- Rate of climb 300 m./min. (985 ft./min.).
- All other figures as for 3201.

THE NORD N.C. 856-A NORVIGIE.

The N.C. 856-A is a development of N.C. 853 which was designed by the now-defunct Société Nationale de Constructions Aéronautiques du Centre. When the S.N.C.A.C. went into liquidation in 1949, the S.N.C.A.N. took over the factory in which the N.C. 853 was being built and has continued production and development.

Whereas the N.C. 853, which has been described and illustrated in previous issues of this Annual, was produced as a civil two-seat trainer for the S.A.L.S., the N.C. 856-A is now in series production (112 aircraft) for the French Army as a two/three-seat A.O.P. and light liaison aircraft, and is described hereafter.

TYPE.—Two/three-seat Artillery Observation and Liaison monoplane.

WINGS.—High-wing rigidly-braced monoplane. Aspect ratio 8.6. There is a slight forward sweep to the constant-chord wings. Incidence 4° at root, 3° 30′ at tip. Single-spar metal structure with fabric covering. Single bracing strut on each side. Metal-framed and fabric-covered trailing-edge flaps and ailerons. Each aileron, which is statically balanced, is provided with an all-metal under flap which droops with the main flaps. Gross wing area 16.85 m.^{2} (181 sq. ft.).

FUSELAGE.—Welded steel-tube structure covered with fabric over light wood formers and stringers.

TAIL UNIT.—Braced monoplane type with twin fins and rudders. Metal framework with fabric covering. Single-piece tailplane braced to fuselage by single struts. Single-piece statically-balanced elevator with two automatically-controllable trim-tabs linked with wing flaps. End plate type fins and aerodynamically-balanced rudders each with a tab adjustable on the ground only. Span of tail 2.684 m. (8 ft. 9½ in.).

LANDING GEAR.—Fixed tail-wheel type. Oleo-pneumatic shock-absorber struts. Mechanical brakes. Orientable tail-wheel with rubber-cord springing.

POWER PLANT.—One 135 h.p. SNECMA 4 LO4 four-cylinder in-line inverted air-cooled engine. Controllable-pitch airscrew. Main fuel tank (110 litres = 24 Imp. gallons) beneath cabin floor. Electric starter.

ACCOMMODATION.—Cabin seats two side-by-side (pilot on port side) with dual controls, and one centrally behind (A.O.P.) or two side-by-side on bench seat (liaison). Doors on each side alongside front seats, backs of which fold forward for access to rear seats. Triangular door on port side aft for loading of stretcher in ambulance version or for access to baggage compartment, which accommodates radio and camera in A.O.P. version.

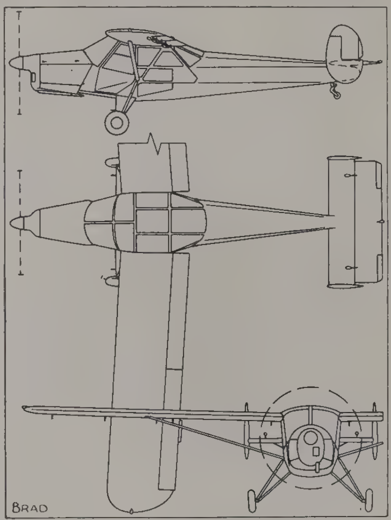
DIMENSIONS.—
Span 12.05 m. (39 ft. 6 in.).
Length 7.70 m. (25 ft. 3 in.).
Height 2.225 m. (7 ft. 4 in.).

WEIGHTS (A.O.P.).—
Weight empty 650 kg. (1,430 lb.).
Movable equipment (radio, camera, etc.) 40 kg. (88 lb.).
Crew (2) and parachutes 166 kg. (365 lb.)
Fuel (40 litres) 29 kg. (64 lb.).
Weight loaded 885 kg. (1,947 lb.).

WEIGHTS (Military Liaison).—
Weight empty 650 kg. (1,430 lb.).
Crew (3) and parachutes 249 kg. (548 lb.).
Fuel (110 litres) 80 kg. (176 lb.).
Baggage, etc. 20 kg. (44 lb.).
Weight loaded 999 kg. (2,198 lb.).

WEIGHTS (Ambulance).—
Weight empty 650 kg. (1,430 lb.).
Crew (2) 150 kg. (330 lb.).
Patient and stretcher 90 kg. (198 lb.).
Fuel (110 litres) 80 kg. (176 lb.).
Baggage, etc. 30 kg. (66 lb.).
Weight loaded 1,000 kg. (2,200 lb.).

Two views of the Nord N.C. 856A (135 h.p. SNECMA 4 LO 4 engine).



The Nord N.C. 856A.

PERFORMANCE (A.O.P.).—
Max speed 190 km.h. (118 m.p.h.).
Cruising speed 170 km.h. (105.5 m.p.h.).
Min. speed 70 km.h. (43.5 m.p.h.).
Initial rate of climb 300 m./min. (984 ft./min.).
Take-off distance to clear 15 m. (50 ft.) 200 m. (218 yds.).
Landing run 90 m. (98 yds.).
Endurance (A.O.P.) 1 hour.
Endurance (liaison) 3 hours.

PERFORMANCE (Ambulance).—
As for A.O.P. version except :—
Min. speed 78 km.h. (48.4 m.p.h.).
Take-off distance to clear 20 m. (66 ft.) 400 m. (437 yds.).
Endurance 3 hours.

THE NORD N.C. 856-H.

The N.C. 856-H three-seat seaplane is derived from the previously-described N.C. 856-A. The installation of the long single-step metal floats has called for an increase in fin area aft, achieved by the addition of a third vertical surface on the fuselage centre-line.

DIMENSIONS.—
Span 12.05 m. (39 ft. 6 in.).
Length 7.78 m. (25 ft. 6 in.).
Height 2.85 m. (9 ft. 4 in.).

WEIGHTS AND LOADINGS.—
Weight empty 775 kg. (1,705 lb.).
Disposable load 325 kg. (715 lb.).
Weight loaded 1,100 kg. (2,420 lb.).
Wing loading 65 kg./m.^{2} (13.32 lb./sq. ft.).
Power loading 7 kg./h.p. (15.4 lb./h.p.).

PERFORMANCE.—
Max. speed 185 km.h. (115 m.p.h.).
Cruising speed 165 km.h. (102 m.p.h.).
Alighting speed 85 km.h. (52.7 m.p.h.).
Initial rate of climb 276 m./min. (905 ft./min.).
Endurance 2 hours 45 min.

The Nord N.C. 856-H Three-seat Seaplane.

THE NORD N.C. 856-N.

The N.C. 856-N is a four-seat civil version of the 856-A military version. The cabin seats its four occupants in two pairs and has fewer transparent panels aft as compared with the military version. The flap system has also been simplified and consists only of camber-changing flaps inboard of the ailerons.

The characteristics of the 856-N are similar to those of the 856-A except for the following weight data :—

WEIGHTS.—
Weight empty 630 kg. (1,386 lb.).
Fuel and oil 80 kg. (176 lb.).
Pilot and 3 passengers 300 kg. (660 lb.).
Weight loaded 1,010 kg. (2,222 lb.).

The Nord N.C. 856-N Four-seat Civil Monoplane.

THE NORD 2501 NORATLAS.

The Nord 2501, which was designed as a military transport for the French Air Force, is also being offered as a civil aircraft suitable for the mixed transport of passengers, bulky freight, vehicles, etc. In the civil version the hold or cabin may be arranged to seat 45 passengers. The cabin is fully sound-proofed, ventilated and heated, while toilet and baggage stowage are provided aft.

The Nord 2501 Noratlas Military Transport (two 2,040 h.p. SNECMA Hercules engines).

A contract for 160 military transports is being fulfilled for the French Government while an order for several civil transports has been received from the Union Aéromaritime de Transports (UAT) and the State of Israel.

A civil version fitted with two Turbomeca Marboré turbojet engines in wing-tip nacelles to improve take-off performance (2502) is under test, while a further version (2503) powered by two Pratt & Whitney R-2800-CB17 engines will be tested during 1955.

The following specification refers to the standard 2501 military or civil cargo transport.

Type.—Twin-engined Military and Civil Transport.

Wings.—High-wing cantilever monoplane. Aspect ratio 10.5. All-metal structure. Wing in three sections, comprising a centre-section which carries the engine nacelles and tail booms at its extremities and supports the central fuselage; and two outer sections. Ailerons and flaps on outer sections. Wing area 101.2 m.^{2} (1,089 sq. ft.).

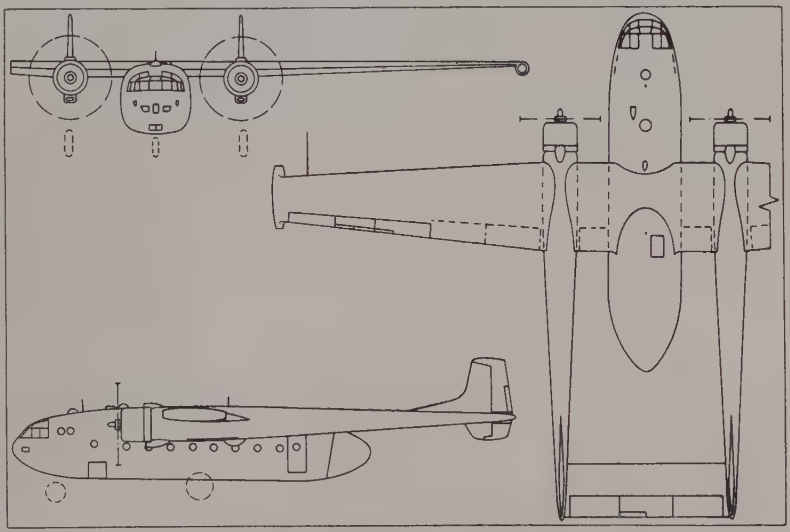
Fuselage.—The central fuselage, of all-metal construction, accommodates the flight deck and the main hold, Two all-metal booms extending aft from engine nacelles carry the tail-unit. Booms are interchangeable right and left.

Tail Unit.—Monoplane type with twin fins and rudders. Fins are integral with tail-booms, tailplane unites the two booms. All-metal structure with metal-covered fixed surfaces and fabric-covered rudders and elevators. Thermal anti-icing for tailplane and fins with single combustion heater on centre-line of tailplane and leading-edge.

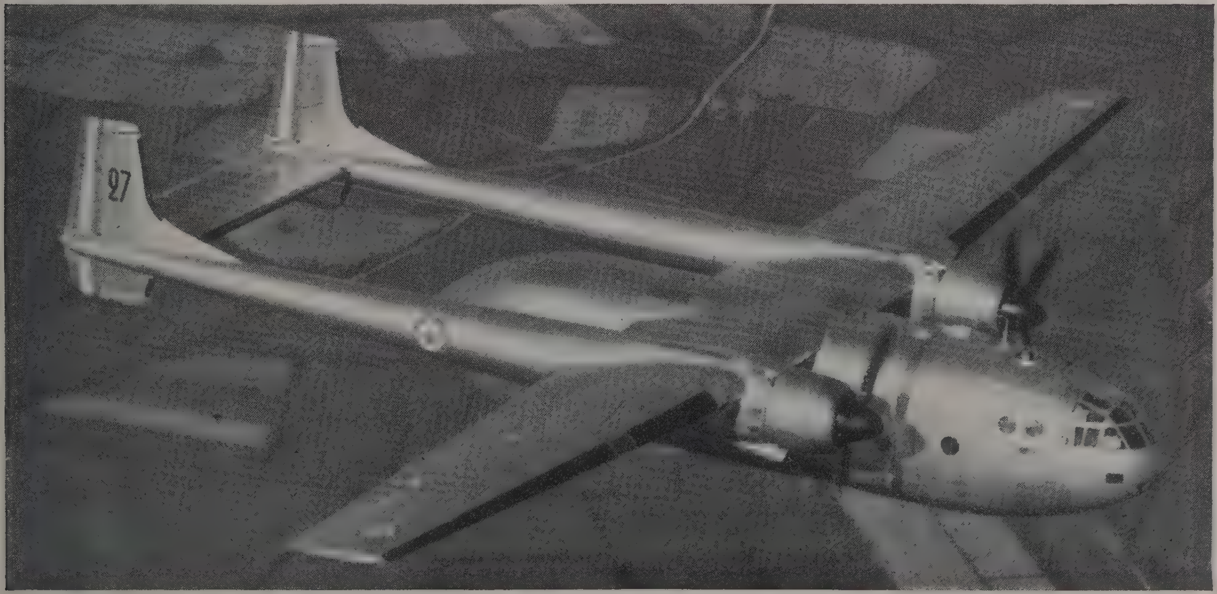
Landing Gear.—Retractable tricycle type. Main landing-gear units are interchangeable right and left. Track 7.760 m. (25 ft. 5 in.).

Power Plant.—Two 2,040 h.p. SNECMA (Bristol licence) Hercules 738 or 758 (without torquemeters) or, optionally, 739 or 759 (with torque-meters) fourteen-cylinder radial air-cooled engines in interchangeable nacelles. Four-blade Rotol controllable-pitch airscrews, non-reversing with Hercules 738 and 739, reversible with Hercules 758 and 759. Fuel tanks carried in centre-section between spars.

Accommodation.—Flight deck accommodates pilot and co-pilot side-by-side, radio operator and navigator on left and right behind pilots and engineer with folding seat on rear bulkhead. Main hold has reinforced floor and in military version can be arranged to transport freight, wheeled vehicles, troops, paratroops, stretchers, etc. Dimensions of hold: length 9.90 m. (32 ft. 5 in.), max. height 2.75 m. (9 ft.), max. width 2.40 m. (7 ft. 10 in.), volume 51 m.^{3} (1,800 cub. ft.). Rear end of fuselage is split vertically and hinged to open to full cross-section of hold for direct loading. Small door forward of wing on port side for access to crew compartment. Main cabin door at aft end of



The Nord 2502 Noratlas Transport.



The Nord 2501 Noratlas Military Transport (two 2,040 h.p. SNECMA Hercules engines).

hold on port side. For loading of heavy cargo through rear loading doors a "Tirfor" 2-ton winch can be attached to any loading ring on the central row, a roller at the hold sill completing the installation.

DIMENSIONS.—
- Span 32.50 m. (106 ft. 7 in.).
- Length 21.962 m. (72 ft.).
- Height 6.00 m. (19 ft. 8 in.).

WEIGHTS AND LOADINGS (Civil version—Bristol Hercules engines).—
- Weight empty equipped 13,075 kg. (28,765 lb.).
- Crew 300 kg. (660 lb.).
- Disposable load (less crew) 7,925 kg. (17,435 lb.).
- Weight loaded 21,000 kg. (46,200 lb.).
- Wing loading 207.5 kg./m.^{2} (42.53 lb./sq. ft.).
- Power loading 5.14 kg./h.p. (11.30 lb./h.p.).

WEIGHTS (Civil version—Pratt & Whitney R-2800 engines).—
- Weight empty equipped (cargo version) 13,272 kg. (29,200 lb.).
- Weight empty equipped (45-passenger version) 13,837 kg. (30,440 lb.).
- Crew 270 kg. (594 lb.).
- Disposable load (cargo version) 8,458 kg. (18,610 lb.).
- Disposable load (45-passenger version) 7,893 kg. (17,365 lb.).
- Weight loaded 22,000 kg. (48,400 lb.).

PERFORMANCE (at 21,000 kg.=46,200 lb. A.U.W.).—
- Max. speed 440 km.h. (273 m.p.h.).
- Cruising speed at 1,500 m. (4,920 ft.) 324 km.h. (201 m.p.h.).
- Cruising speed at 3,000 m. (9,840 ft.) 335 km.h. (208 m.p.h.).
- Rate of climb at S/L. 375 m./min. (1,230 ft./min.).
- Rate of climb at 3,000 m. (9,840 ft.) 285 m./min. (935 ft./min.).
- Rate of climb on one engine at 1,500 m. (4,920 ft.) 60 m./min. (200 ft./min.).
- Service ceiling 7,500 m. (24,600 ft.).
- Service ceiling on one engine 2,300 m. (7,545 ft.).
- Take-off run 660 m. (720 yds.).
- Take-off distance to clear 15 m. (50 ft.) 820 m. (893 yds.).
- Landing distance from 15 m. (50 ft.) 790 m. (863 yds.).
- Landing run with reversing airscrews 420 m. (459 yds.).

THE NORD 1750 NORELFE.

This helicopter was developed by the French engineer Jean Cautineau who is now with the Spanish company Aerotécnica S.A. Two prototypes have been built by S.N.C.A.N., one for Aerotécnica S.A. which sponsored the design and by whom it is known as the AC-13, while the other is being flight-tested by S.N.C.A.N., which holds a constructional licence for the design and has given it a Nord type number and name.

The Norelfe is powered by a de-rated Turbomeca Artouste gas turbine which drives the three-blade rotor. The residual thrust is ducted aft through the tubular fuselage, the extreme end of which is articulated and can be operated by pedal control. At speeds up to 80 km.h. (50 m.p.h.) torque compensation

The Nord 1750 Norelfe Helicopter (Turbomeca Artouste shaft turbine).

and directional control is obtained by control of the exhaust jet but above that speed control is transferred automatically to two vertical tail surfaces which take care of both torque compensation and steering.

In its present form the Norelfe is an experimental craft. It has accommodation for pilot and up to two passengers in an enclosed cabin. Its general arrangement can be seen in the accompanying illustration.

DIMENSIONS.—
- Rota diameter 9.04 m. (28 ft. 7 in.).
- Length 7.95 m. (25 ft. 1 in.).
- Height 2.70 m. (8 ft. 7 in.).

WEIGHTS.—
- Weight empty 560 kg. (1,234 lb.).
- Weight loaded (single-seater) 700 kg. (1,543 lb.).
- Weight loaded (three-seater) 860 kg. (1,892 lb.).

PERFORMANCE (at 860 kg.=1,892 lb. A.U.W.).—
- Max. speed 145 km.h. (90 m.p.h.).
- Cruising speed 120 km.h. (74.5 m.p.h.).
- Rate of climb (forward flight) 4 m./sec. (480 ft./min.).
- Ceiling (without ground effect) 800 m. (2,625 ft.).
- Ceiling (forward flight) 4,600 m. (15,090 ft.).
- Cruising endurance 1 hour.

THE NORD CT.10 (ARS.5.501).

The CT.10 is a remotely-controlled pilotless target aircraft which is powered by an Arsenal pulse-jet developing a thrust of 180 kg. (396 lb.). It is now being used by both the French and British Navies.

The body is in three sections, a nose section of mild steel housing the automatic pilot and controlling gear; the centre-section, also of mild steel, supporting the cantilever mid-wing surfaces and housing the fuel tanks; and a tail section of light alloy carrying the twin-finned monoplane tail-unit. The pulse-jet power-unit is supported above the rear half of the body by faired vertical struts, the front member enclosing the fuel lines to the engine.

The CT.10 is launched from a ramp which may be either land-based or sea-borne. The launching carriage is propelled by two powder rockets and after separation at approximately 200 ft. the carriage is lowered by parachute.

A radio-controlled auto-pilot permits all normal manoeuvres—turns to right and left, climb, descent. The signal for stopping the engine is also given by radio, the landing and recovery procedure being as follows :—after the engine has stopped and speed has been reduced sufficiently, a parachute is released and the remaining fuel is jettisoned through a dump-valve. In the event of a water landing the target floats until recovered. In a descent on land the steel needle nose section digs into the ground.

The ARS.5.501 is successfully used for both anti-aircraft and anti-missile gunnery training. It is also employed for testing instrumentation, etc. for all kinds of air interception operations.

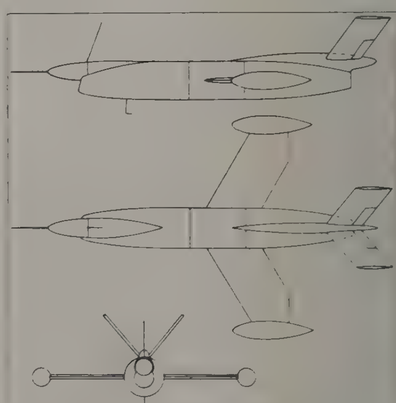
DIMENSIONS.—
- Span 4.300 m. (14 ft. 1½ in.).
- Length 6.014 m. (19 ft. 8 in.).
- Height 1.092 m. (3 ft. 7 in.).

WEIGHTS.—
- Weight loaded 660 kg. (1,452 lb.).

PERFORMANCE.—
- Speed at 4,000 m. (13,120 ft.) 460 km.h. (286 m.p.h.).
- Climb to 4,000 m. (13,120 ft.) 10 min.
- Range 320 km. (200 miles).

THE NORD CT.20 (T.5.510).

The CT.20 is a turbojet-powered radio-controlled target with a performance comparable with that of modern service aircraft.



The Nord CT.20 Pilotless Target.

The CT.20's launching and control systems are generally similar to those of the CT.10 previously described, although, naturally, engine starting is different. The target is launched from a short mobile ramp 10 m. (32 ft. 9½ in.)

The Nord CT.10 (Ars 5.501) pilotless target on its launching ramp.

long and inclined at an angle of 5 degrees to the horizontal. The launching carriage is powered by two powder rockets and aided by the power of the turbojet engine the CT. 20 has reached a speed of 610 km.h. (555.9 ft./sec.) by the time it has reached its maximum acceleration. The drone then continues to flight under the control of the radio-operator located on the ground or in a "mother" aircraft.

Six signals can be transmitted, turns to right and left, nose up and down, land and trace smoke. The turning signal controls bank and the turns are executed without any reverse yaw. The pitch signals act directly on the elevators. When the landing signal is transmitted, the engine is stopped and the brake parachute opens and, at the end of a delay period, the recovery parachute is released. The descent is made in a level altitude and the impact with the ground is cushioned by two air-bags placed fore and aft of the centre-section. In the case of radio-control failure the landing sequence occurs automatically.

Type. — Turbojet-powered radio-controlled Drone.

Wings.—Mid-wing monoplane with medium sweepback. Two half wings have two steel-tube spars and aluminium-alloy ribs and covering. Lateral control spoilers at wing tips. Gross wing area 3.2 m.^{2} (33.34 sq. ft.).

Fuselage.—In three main sections. Forward section of aluminium alloy, contains command-guidance, auto-pilot, batteries and principal recovery parachute. Central section composed of a structural steel tank divided into two parts, one for turbofuel and the other containing chemicals for the tracking smoke. Rear fuselage, of aluminium-alloy, contains the engine and carries the tail-unit. A braking parachute is housed in the cone above the jet nozzle.

Tail Unit.—Butterfly type. Of aluminium-alloy construction. Comprises two elevator surfaces simultaneously controlled by a single jack.

Power Plant.—One Turbomeca Marboré II turbojet engine (400 kg. = 680 lb. s.t.).

Dimensions.—
Span 3.4 m. (11 ft. 2 in.).
Length 5.4 m. (17 ft. 8 in.).

Weight.—
T.O. weight 655 kg. (1,444 lb.).

Performance.—
Speed at 10,000 m. (32,800 ft.) 900 km.h. (560 m.p.h.).
Time to 10,000 m. (32,800 ft.) 5 min.
Service ceiling 10,000 m. (32,800 ft.)
T.O. acceleration 10 g.
Mean endurance 45 min.

PAYEN

PAYEN-AVIATION.

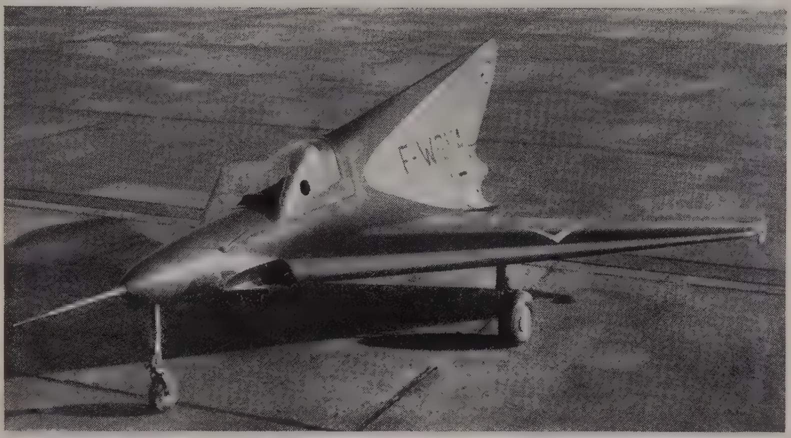
Head Office: 242, Rue de Rivoli, Paris (Ier).

Works: 13, Quai de l'Industrie, Juvisy (Seine).

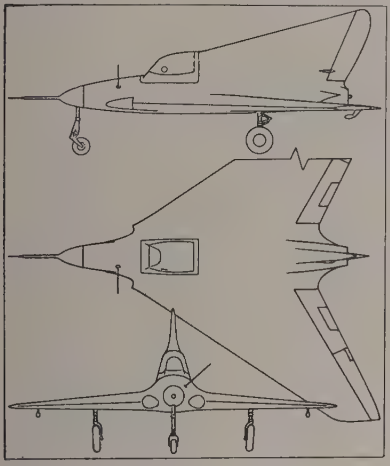
Engineer Payen has been engaged in research and development of the delta-wing for the past twenty-five years. He built two delta-wing aircraft before the war, one a light aircraft which flew satisfactorily, and the other a fighter type aircraft which was destroyed during the war.

THE PAYEN PA. 49.

In 1951 M. Payen began the construction of the PA.49, an experimental single-seat jet propelled tail-less flying-wing with sharp leading edge and moderate trailing-edge sweepback. The wing is fitted with elevators and ailerons. A large triangular fin, the front end of which forms the cockpit fairing, extends over two-thirds of the length of the fuselage. This aircraft made its first flight on January 22, 1954.



The Payen PA.49 Light Delta-wing Research Monoplane.



The Payen PA.49.

After satisfactorily completing its preliminary trials at Melun-Villaroche, the PA.49 was sent to the Centre d'Essais en Vol, Brétigny, where it completed its first series of tests. It was then fitted with a new Flêchair air-brake system. This takes the form of a split rudder which is effective as a brake throughout the rudder range. Later it is intended to fit the PA.49 with a retractable landing-gear.

The PA.49 is of all-wood construction and is powered by a Turbomeca Palas turbojet engine (150 kg. = 330 lb. s.t.).

Dimensions.—
Span 5.16 m. (16 ft. 11 in.).
Length 5.10 m. (16 ft. 8½ in.).
Height 2.50 m. (8 ft. 2¼ in.).

Weights and Loadings. —
Weight empty 457 kg. (1,005 lb.).
Weight loaded 650 kg. (1,430 lb.).
Wing loading 57 kg./m.^{2} (11.68 lb./sq. ft.).

Performance (with fixed L/G.).—
Max. speed 500 km.h. (310 m.p.h.).
Cruising speed 350 km.h. (217 m.p.h.).
Take-off speed 145 km.h. (90 m.p.h.).
Landing speed 100 km.h. (62 m.p.h.).
Initial rate of climb 350 m./min. (1,150 ft./min.).
Ceiling 8,500 m. (27,880 ft.).
Range 450 km. (280 miles).
Take-off run 420 m. (459 yds.).

PIEL

C. PIEL AVIATION.

Office and Works: 284, Avenue Jean Jaurès, Drancy (Seine).

Director: Claude Piel.

M. Claude Piel has designed and built several light aircraft. His latest is the C.P. 30 Emeraude which is being supplied in completed form and in constructional kits for the amateur builder. Details of this aircraft follow.

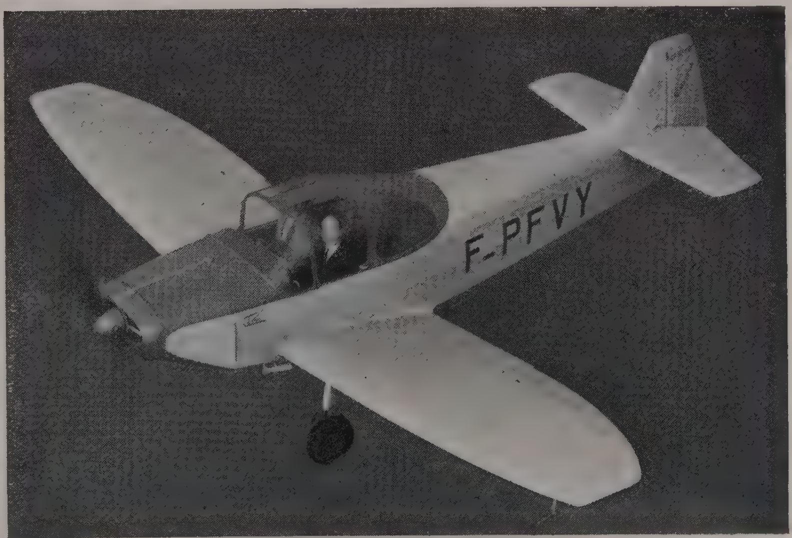
THE PIEL C.P.30 EMERAUDE.

Type.—Two-seat light monoplane.

Wings.—Low-wing cantilever monoplane. NACA 23012 wing section. Aspect ratio 5.95. Chord 1.50 m. (4 ft. 11 in.) at root, 0.55 m. (1 ft. 9½ in.) at tip. Dihedral 5°. Inner half of each wing is rectangular in plan, outer half elliptical. All-wood single-spar structure with fabric-covering over all. Slotted ailerons. Gross wing area 10.85 m.^{2} (116.7 sq. ft.).

Fuselage.—Rectangular wooden structure with domed deck. Two sides are pre-fabricated Warren-girder structures which are joined together by three main bulkheads and other cross members. Covering is fabric over light longitudinal stringers.

Tail Unit.—Cantilever monoplane type. Fin integral with fuselage. Single-piece single-spar all-wood tailplane. Elevators



The Piel C.P.30 Emeraude (65 h.p. Continental A65 engine).

and rudder are fabric-covered. Trim-tab in starboard elevator.

LANDING GEAR.—Fixed type. Cantilever legs have rubber-in-compression springing. Hydraulic wheel-brakes. Leaf sprung tail skid. Track 2 m. (6 ft. 6 in.).

POWER PLANT.—One 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine. Holleville two-blade fixed-pitch wood airscrew. Fuel tank in fuselage behind fireproof bulkhead.

ACCOMMODATION.—Enclosed cockpit seating two side-by-side with dual controls. Sides of canopy hinge forward for access and exit. Heating and air-conditioning.

DIMENSIONS.—
Span 8.02 m. (26 ft. 3½ in.).
Length 6.40 m. (20 ft. 11½ in.).

WEIGHTS.—
Weight empty 265 kg. (583 lb.).
Weight loaded 490 kg. (1,078 lb.).

PERFORMANCE.—
Max. speed 190 km.h. (118 m.p.h.).
Cruising speed 170 km.h. (106 m.p.h.).
Min. speed 60 km.h. (37.2 m.p.h.).
Range 750 km. (465 miles).

POTEZ

SOCIÉTÉ DES AVIONS ET MOTEURS HENRY POTEZ.

HEAD OFFICE: 46, AVENUE KLEBER, PARIS (XVIE).

WORKS: ARGENTEUIL (S-ET-O).

In 1953 the Société Henry Potez signalised its return to aircraft manufacture, after a lapse of seventeen years, with the appearance of the Potez 75 Army Ground-support monoplane.

The original Potez company was formed during the 1914-18 war and up to the nationalisation of the French aircraft industry in 1936 Potez was one of the largest and most productive of French aircraft manufacturers.

In 1936 the Potez aircraft factories at Méaulte (Somme) and Sartrouville (S-et-O) were incorporated in the Société Nationale de Constructions Aéronautiques du Nord, and that at Berre (Bouches-du-Rhône) in the S.N.C.A. de Sud-Est.

Potez had begun to build aero-engines in 1929 and this branch of the company retained its independence in 1926 under the name of Laboratoire Experimental de Moteurs. After the last war this concern became the Société des Motéurs Potez and in 1953 the name was changed to Société des Avions et Moteurs Henry Potez in order to embrace its widened activities. For details of the aero-engine products of this company see under "Potez" in the Aero-Engine Section.

The Potez 75 (450 h.p. Potez 8-D-32 engine).

THE POTEZ 75.

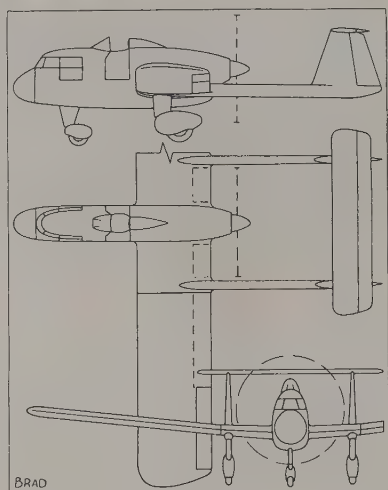
The Type 75 has been designed to meet the requirements of the ground forces as an economical ground support and anti-tank weapon. It is heavily armed and armoured and will be equipped to carry rockets and guided missiles. The prototype flew for the first time on June 10, 1953.

In 1955 the Potez 75 underwent evaluation trials to examine its suitability for police duties in French overseas territories.

TYPE.—Two-seat Ground Support monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal structure. Centre-section carries the nacelle and roots for tail booms. Wing sections outboard of centre-section have dihedral of 4°. Gross wing area 23 m.² (247 sq. ft.).

FUSELAGE.—Consists of central all-metal nacelle accommodating crew and pusher engine. All metal tubular tail booms support tail unit.



The Potez 75

TAIL UNIT.—One-piece tailplane and inset elevator supported on top of fins integral with tail-booms. All-metal structure.

LANDING GEAR.—Fixed nose-wheel type. Knee-action oleo shock-absorbers to all units.

POWER PLANT.—One Potez 8-D.32 eight-cylinder inverted Vee air-cooled engine rated at 350 h.p. at sea level and with 480 h.p. available for take-off. Pusher propeller.

ACCOMMODATION.—Enclosed armoured cockpit in nose for observer/weapon control operator. Aft and above is the open cockpit, also armoured for pilot. Nose of nacelle is detachable to permit change of equipment, etc. for various missions.

ARMAMENT.—One fixed heavy-calibre automatic cannon in nose of nacelle. Provision for guided missiles, rockets, etc.

DIMENSIONS.—
Span 13.10 m. (42 ft. 11 in.).
Length 9.16 m. (29 ft. 1 in.).
Height 2.70 m. (8 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty (equipped) 1,800 kg. (3,968 lb.).
Disposable load 600 kg. (1,307 lb.).
Weight loaded 2,400 kg. (5,228 lb.).
Wing loading 105 kg./m.² (21 lb./sq. ft.).
Power loading 5 kg./h.p. (10.9 lb./h.p.).

PERFORMANCE (at 2,400 kg. = 5,228 kg. A.U.W.).—
Max. speed (with missiles) 275 km.h. (170.5 m.p.h.).
Cruising speed (75% power) 225 km.h. (139.5 m.p.h.)
Take-off speed 110 km.h. (68.2 m.p.h.).
Landing speed 110 km.h. (68.2 m.p.h.).
Initial rate of climb 480 m./min. (1,575 ft./min.).
Take-off run 175 m. (190 yds.).
Landing run 165 m. (180 yds.).
Take-off distance to 15 m. (50 ft.) 470 m. (510 yds.).
Landing distance from 15 m. (50 ft.) 275 m. (300 yds.).
Range 700 km. (435 miles).

SIPA

SOCIÉTÉ INDUSTRIELLE POUR L'AÉRONAUTIQUE.

HEAD OFFICE AND WORKS: 1, PLACE EUGÈNE-SUE, SURESNES (SEINE).

This Company was formed in 1938. Until 1940 it was engaged in the manufacture of parts and components for Lioré-et-Olivier, Amiot and Morane aircraft and the overhaul of Mureaux aircraft for the French Air Ministry.

Its first post-war production was the S.10, the French version of the Arado Ar 396. This was followed by the S.11 and S.111, which are modified versions fitted with the SNECMA 12S (the French-built Argus As 411), and the S.12 which is entirely of metal construction. The company has since produced fifty S.121 trainers, this model differing in only minor details from the S.12. This last-mentioned order brought the total number of aircraft in this series (S.10, S.11, S.111, S.12 and S.121) which have been built for the French Air Force to 234. SIPA is now engaged in converting the earlier S.11's up to S.121 standard.

The SIPA 901 was selected by the Government for use in the schools of the Service de l'Aviation Légère et Sportive and a production order for 100 was completed in 1952.

The latest SIPA products are the SIPA 1000 Coccinelle low-cost light monoplane, the SIPA 300 jet primary trainer and the SIPA 200 light liaison monoplane or jet basic trainer, all of which are described hereafter.

THE SIPA 1000 COCCINELLE.

The SIPA 1000 is a two-seat light monoplane which was specifically designed for large-scale production; its outstanding characteristics being simplicity and cheapness of manufacture and operation. The

The SIPA 1000 Coccinelle (65 h.p. Continental A65 engine).

design was begun on April 4, 1955, and the prototype first flew on June 11, 1955.

Type.—Two-seat light monoplane.

Wings.—Low-wing cantilever monoplane. All-metal framework covered with fabric. Each half wing quickly detachable from fuselage. Double-slotted flaps and single slotted interchangeable ailerons. Gross wing area 9.50 m.^{2} (102.2 sq. ft.).

Fuselage.—Welded steel-tube structure covered forward with detachable light metal panels and aft with fabric.

Tail Unit.—Cantilever monoplane type. Welded steel-tube frames covered with fabric. Automatic elevator tab linked with flap operating mechanism.

Landing Gear.—Fixed nose-wheel type. Low-pressure oleo-pneumatic shock-absorbers. Automobile-type wheel-brakes. Parking brake. Steerable nose-wheel. Wheelbase 1.33 m. (4 ft. 4 in.). Track 1.90 m. (6 ft. 3 in.).

Power Plant.—One 65 h.p. Continental A65-8F or 12F, or 90 h.p. C90-8F or 12F four-cylinder horizontally-opposed air-cooled engine (8F engines without electric starter, 12F engines have electric starter and generator). Two-blade fixed-pitch wood airscrew. Quickly-removable two-piece cowling. Fuel capacity 75 litres (34 Imp. gallons).

Accommodation.—Cockpit seats two side-by side with dual controls. Sliding 360° vision canopy. Sound-proofing and air-conditioning. All controls accessible to both occupants.

Dimensions.—
- Span 7.90 m. (25 ft. 11 in.).
- Length 5.45 m. (17 ft. 10½ in.).
- Height 2.20 m. (7 ft. 2½ in.).

Weights (65 h.p. A65 engine).—
- Weight empty 310 kg. (682 lb.).
- Weight loaded 535 kg. (1,177 lb.).

Weights (90 h.p. C90 engine).
- Weight empty 335 kg. (737 lb.).
- Weight loaded 570 kg. (1,254 lb.).

Performance (65 h.p. A65 engine).—
- Max. speed 175 km.h. (109 m.p.h.).
- Cruising speed 160 km.h. (100 m.p.h.).
- Landing speed (without flaps) 70 km.h. (43.5 m.p.h.).
- Landing speed (with flaps) 50 km.h. (31 m.p.h.).
- Take-off run 150 m. (164 yds.).
- Take-off distance to clear 20 m. (66 ft.) 350 m. (383 yds.).
- Landing run 40 m. (33 yds.).
- Range 700 km. (435 miles).

Performance (90 h.p. C90 engine).
- Max. speed 200 km.h. (124 m.p.h.).
- Cruising speed 180 km.h. (112 m.p.h.).
- Landing speed (without flaps) 75 km.h. (46.5 m.p.h.).
- Landing speed (with flaps) 55 km.h. (34 m.p.h.).
- Take-off run 100 m. (109 yds.).
- Take-off distance to clear 20 m. (66 ft.) 250 m. (273 yds.).
- Landing run 40 m. (33 yds.).
- Range 600 km. (375 miles).

THE SIPA 300.

Type.—Two-seat Jet Primary Trainer.

Wings.—Low-wing cantilever monoplane. All-metal structure. Flaps inboard of ailerons. Hydraulically-operated circular-plate type air brakes. Gross wing area 9.80 m.^{2} (105.6 sq. ft.).

Fuselage.—All-metal structure.

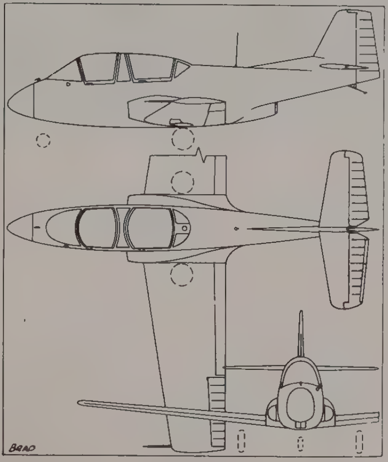
Tail Unit.—Cantilever monoplane type. All-metal structure.

Landing Gear.—Retractable nose-wheel type. Hydraulic actuation. Wheelbase 2.52 m. (8 ft. 3 in.). Track 2.20 m. (7 ft. 3 in.).

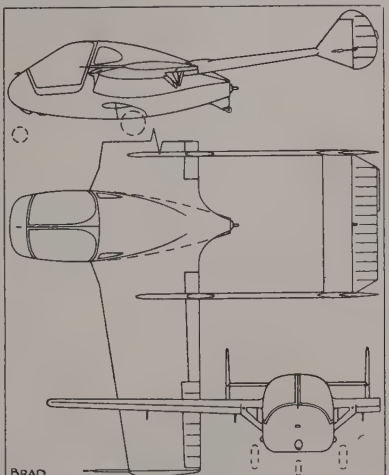
Power Plant.—One Turbomeca Palas turbojet engine (160 kg.=253 lb. s.t.) mounted in lower part of central fuselage with jet pipe beneath the fuselage midway between wings and tail. Bifurcated air-inlet with entries at wing root leading-edges. Normal internal fuel capacity 210 litres (46 Imp. gallons). Provision for additional fuel in wing-tip tanks (50 litres=11 Imp. gallons each). Oil capacity 4 litres (7 pints).

Accommodation.—Tandem seats under continuous transparent canopy with separate and jettisonable side-hingeing sections over each cockpit. Complete dual controls. Adjustable seats and rudder pedals. Full blind-flying equipment. VHF radio with three frequencies.

The SIPA 300 Trainer (Turbomeca Palas turbojet engine).



The SIPA 300.



The SIPA 200 Minijet.

Dimensions.—
- Span 8.020 m. (26 ft. 4 in.).
- Length 6.710 m. (22 ft.).
- Height 2.565 m. (8 ft. 5 in.).

Weights and Loading.—
- Weight empty 583 kg. (1,283 lb.).
- Crew (two) 168 kg. (370 lb.).
- Fuel and oil 168 kg. (370 lb.).
- Weight loaded 920 kg. (2,024 lb.).

Performance.—
- Max. speed 360 km.h. (224 m.p.h.).
- Max. cruising speed 312 km.h. (194 m.p.h.).
- Rate of climb 270 m./min. (886 ft./min.).
- Service ceiling 5,050 m. (16,570 ft.).
- Range 450 km. (280 miles).
- Landing speed 90 km.h. (56 m.p.h.).
- Take-off run 365 m. (400 yds.).

THE SIPA 200 MINIJET.

The SIPA 200, the first all-metal two-seat light jet-propelled aircraft to fly in the World, was designed as a light high-speed liaison aircraft or a basic trainer. The first airframe was exhibited at the 1951 Paris Aero Show and was later used for static tests. The second aircraft to be built flew for the first time on January 14, 1952, 347 days after the design was begun.

Four SIPA Minijets are in service at the St. Yan National Powered Flight Centre where they are being used for jet conversion training.

Type.—Two-seat Jet Basic Trainer or Light Liaison monoplane.

Wings.—Mid-wing cantilever monoplane. Laminar-flow wing section. Dihedral 3°. All-metal structure. Double slotted Fowler type flaps. Aerodynamically-balanced slotted ailerons. Gross wing area 9.6 m.^{2} (104 sq. ft.).

Fuselage.—All-metal nacelle and two metal tail booms.

Tail Unit.—Tailplane and single elevator mounted between extremities of tail booms, which each terminate in fin and rudder. All-metal structure. Tailplane span: 2 m. (6 ft. 8 in.).

Landing Gear.—Retractable tricycle type. Hydraulic retraction. Hydraulic shock-absorber struts and wheel-brakes. Track: 1.23 m. (4 ft. 1 in.).

Power Plant.—One Turbomeca Palas I turbojet engine (150 kg.=330 lb. s.t.) mounted in aft section of central nacelle behind a fireproof bulkhead. Air intakes in wing roots.

Accommodation.—Enclosed cabin seating two side-by-side with dual controls. May also be flown as aerobatic single-seater.

Dimensions.—
- Span 8.0 m. (26 ft. 2 in.).
- Length 5.12 m. (16 ft. 11 in.).
- Height 1.78 m. (5 ft. 10 in.).

Weights and Loadings.—
- Weight empty 450 kg. (990 lb.).
- Crew (2) 166 kg. (365 lb.).
- Fuel and oil 163 kg. (359 lb.).
- Weight loaded 779 kg. (1,675 lb.).
- Wing loading 81.1 kg./m.^{2} (16.62 lb./sq. ft.).

Performance.—
- Max. speed at S/L. 400 km.h. (248 m.p.h.).
- Cruising speed at 1,000 m. (3,280 ft.) 360 km.h. (223 m.p.h.).
- Initial rate of climb 5.75 m./sec. (1,140 ft./min.).
- Max. ceiling 8,000 m. (26,240 ft.).
- Range (without tip tanks) 550 km. (340 miles).
- Take-off run 300 m. (328 yds.).

The SIPA 200 Minijet (Turbomeca Palas turbojet engine).

SUD-EST

The S.E.210 Caravelle Medium-Range Airliner (two Rolls-Royce Avon turbojet engines).

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DE SUD-EST (S.N.C.A.S.E.).

HEAD OFFICE: 6, AVENUE MARÇEAU, PARIS (VIIIe).

WORKS: LA COURNEUVE (SEINE), TOULOUSE (HAUTE-GARONNE), MARIGNANE (NEAR MARSEILLE) AND CANNES (ALPES-MARITIMES).

President-Director General: Georges Hereil.

Director of Production: Louis Giusta.

Commercial Director: M. Detard.

Technical Director: André Vautier.

The Société Nationale de Constructions Aéronautiques de Sud-Est was formed on December 21, 1936, in accordance with the Law of Nationalisation of Military Industries. It included factories formerly owned by the Lioré-et-Olivier, Romano and S.P.C.A. Companies. In 1941 it absorbed the factories of the former Société Nationale de Constructions Aéronautiques du Midi.

In 1955 the first of two prototypes of the S.E.210 Caravelle twin-jet medium-range airliner was completed and flown. The second prototype was due for completion in 1956.

Since its first flight on August 1, 1953, the SE.5000 Baroudeur single-seat fighter with a novel type of separate take-off trolley and retractable landing-skids, has continued its tests with success. A second prototype flew on May 12, 1954. A pre-series of three is being built.

Sud-Est is developing a delta-wing interceptor fighter, the S.E.212 Durandal, of which no details are available for publication.

Production of the Mistral, a development of the Vampire was completed in 1953 and it was followed on the production lines by the Aquilon, the name given to the French version of the de Havilland Sea Venom. The first production Aquilon flew for the first time on March 25, 1954.

In the helicopter field Sud-Est has built the S.E.3130 which is powered by a Turbomeca Artouste turbine. The S.E. 3130 Alouette II is now in production for the French Navy.

In 1952 Sud-Est acquired the manufacturing licence for the Sikorsky S-55 helicopter, to which it has given the name Joyeux Eléphant. A number has been built for the French Government.

Sud-Est is also undertaking important sub-contract work, including the production of complete fuselages for the Dassault Mystère II and IV and the Fouga Magister, and the manufacture of components for the Republic F-84F Thunderstreak for Republic Aviation International. It is also repairing and overhauling Republic F-84E and G Thunderjets for the French Air Force.

In 1955 an agreement was arrived at with Hurel-Dubois whereby the S.N.C.A.S.E. assumes the responsibility for the production and sale of the H.D.32 and its derivations.

THE S.E.210 CARAVELLE.

Two prototypes of the S.E. 210 medium-range twin-jet airliner are under construction to the order of the Secretariat d'Etat a l'Air. The first made its maiden flight on May 27, 1955.

TYPE.—Twin-jet Medium-Range Airliner.

WINGS.—Low-wing cantilever monoplane. NACA 65212 wing section. Aspect ratio 8.02. Sweepback 20° at 25% of chord. Dihedral 3°. Incidence at root 2°. Chord 6.33 m. (20 ft. 9 in.) at root, 2.23 m. (7 ft. 4 in.) at tip. Wing in two sections joined on fuselage centre-line. All-metal structure. Leading-edge flaps. Slotted trailing-edge flaps. Air brakes on upper and lower surfaces ahead of flaps. Thermal de-icing. Gross wing area 146.7 m.² (1,579 sq. ft.).

FUSELAGE.—Circular section all-metal monocoque structure. Overall length 31.5 m. (103 ft. 4 in.). Maximum diameter 3.20 m. (10 ft. 6 in.). Length of pressurised section 25.45 m. (83 ft. 5 in.).

TAIL UNIT.—Cantilever monoplane type. Sweepback of tailplane 30° at 25% of chord. All-metal structure. Thermal de-icing. Area of vertical surfaces 15.5 m.² (166.78 sq. ft.). Area of horizontal surfaces 28 m.² (301.28 sq. ft.).

LANDING GEAR.—Retractable nose-wheel type. Twin nose-wheel unit. Each main unit has a four-wheel bogie. Hydraulic retraction. Maxaret anti-skid brakes on main wheels. Track of main units (between centre-line of shock struts) 5.28 m. (17 ft. 4 in.). Wheelbase 11.33 m. (37 ft. 2 in.).

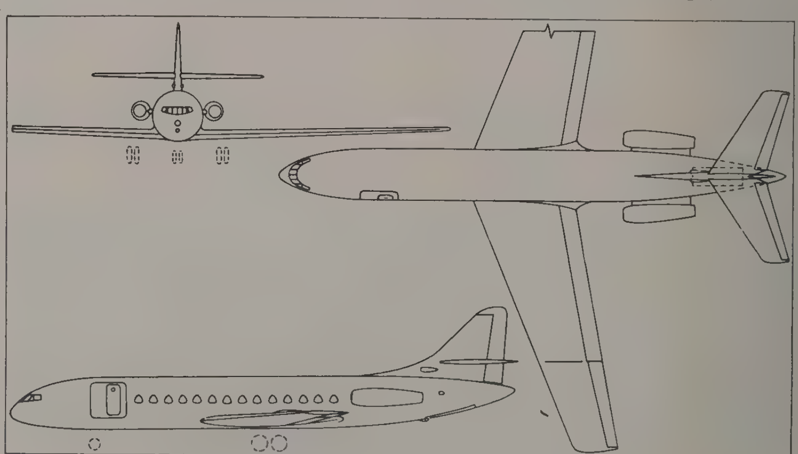
POWER PLANT.—Two Rolls-Royce Avon RA.16 axial-flow turbojet engines 4,540 kg. (=10,000 lb. s.t. each) mounted in nacelles one on each side of the rear fuselage just ahead of tail-unit. Integral wing fuel tanks. Total fuel capacity 18,600 litres (4,100 Imp. gallons).

ACCOMMODATION.—Crew compartment in nose. Main cabin, with maximum accommodation for 70 passengers. Entire accommodation pressurised to maintain a cabin atmosphere of 2,500 m. (11,480 ft.) to a height of 11,000 m. (36,080 ft.). Main access to cabin aft through door under rear fuselage with hydraulically-operated integral steps. Steps serve as tail support when lowered. Cabin floor 2.10 m. (6 ft. 10 in.). above ground level. Large freight compartment forward of main cabin with upward-hinged door on port side 2 m. wide × 1.8 m. high (6.56 × 5.90 ft.). Two toilets and coat rooms and light baggage racks aft of cabin. Baggage holds beneath cabin floor fore and aft of wing. Cabin may be adapted for freight or, with movable bulkhead, passenger/freight use. Cabin floor is stressed for concentrated loads while seats may be arranged to fold up against cabin walls and seat attachments used for freight lashing points.

DIMENSIONS.—
Span 34.30 m. (112 ft. 6 in.).
Length 31.50 m. (103 ft. 4 in.).
Height 8.69 m. (28 ft. 6 in.).

WEIGHTS (Designed—for max payload).—
Weight empty equipped 19,065 kg. (41,943 lb.).
Crew 385 kg. (847 lb.).
Fuel and oil 15,050 kg. (33,110 lb.).
Payload 9,500 kg. (20,900 lb.).
Take-off weight 44,000 kg. (96,800 lb.).

WEIGHTS (Designed—for max. range).—
Weight empty equipped 19,065 kg. (41,943 lb.).
Crew 385 kg. (847 lb.).
Fuel and oil 17,600 kg. (38,720 lb.).
Payload 2,950 kg. (6,490 lb.).
Take-off weight 40,000 kg. (88,000 lb.).
Max. landing weight 36,000 kg. (79,200 lb.).



The S.E.210 Caravelle Medium-Range Airliner.

The S.E.5000 Baroudeur Light Fighter (SNECMA Atar 101 turbojet engine).

Performance (Estimated).—
Cruising speed (40,000 kg.=88,000 lb. A.U.W.) 740 km.h. (460 m.p.h.) at 9,600 m. (31,490 ft.).
Cruising speed (35,000 kg.=77,000 lb. A.U.W.) 770 km.h. (478 m.p.h.) at 11,000 m. (36,080 ft.).
Cruising speed (30,000 kg.=66,000 lb. A.U.W.) 770 km.h. (478 m.p.h.) at 11,800 m. (38,700 ft.).
Cruising range (9,500 kg.=20,900 lb. payload) without reserves, no wind 4,300 km. (2,670 miles).
Cruising range (2,950 kg.=6,490 lb. payload) without reserves, no wind 6,400 km. (3,975 miles).
Take-off run at 44,000 kg.=96,800 lb. A.U.W. 1,450 m. (4,756 ft.).
Take-off distance to clear 11.0 m. (36 ft.) at 44,000 kg.=96,800 lb. A.U.W. 1,580 m. (5,182 ft.).

THE S.E.5000 BAROUDEUR.

The S.E.5000 is a single-seat jet fighter which has been designed to operate independently of airfields with long runways. For take-off it uses a three-wheeled trolley and it lands on skids.

The take-off trolley, of welded steel tubing, reproduces the layout of a nose-wheel landing-gear. All wheels have low-pressure tyres and are sprung by rubber blocks. The rear wheels are fitted with brakes which are operated by the pilot while the aircraft is on the trolley, or automatically after the aircraft has taken off. The trolley can be fitted with six rockets, two or four being used for take-off according to the type of terrain, and two are for emergency use.

The aircraft is mounted on its take-off trolley by a winch-fitted Jeep, which tows the trolley into position and then hauls the aircraft into place. The operation can be completed in under two minutes.

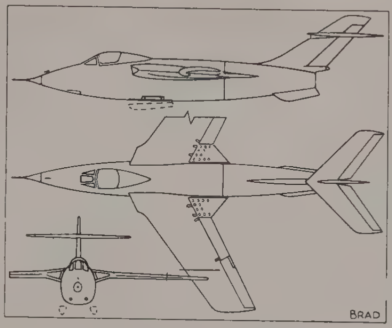
For landing the S.E.5000 is fitted with three retractable skids, two main forward and one auxiliary aft. A special skid brake reduces the landing run and permits ground manoeuvrability comparable to that of the conventional wheeled aircraft.

Primarily the S.E. 5000 will be armed as an attack fighter but it can be equipped as a light tactical fighter.

It is claimed that the S.E. 5000 has a performance equal to that of the best existing fighters but that it is able to operate from airfields with a take-off run of the order of 700 m. (765 yds.). The S.E.5000 has demonstrated its ability to operate from uncultivated fields, sand and pebble beaches and muddy or frozen ground.

The first prototype S.E.5000 made its first flight on August 1, 1953. A second prototype flew for the first time on May 12, 1954, and on July 17 this aircraft exceeded Mach. 1 in a dive. A pre-series of three is under construction.

Type.—Single-seat Jet Fighter.
Wings.—Shoulder-wing cantilever monoplane. Leading-edge sweepback 38°. All-metal structure made up of one main spar, two auxiliary spars, closely spaced ribs and smooth flush-riveted skin. Leading-edge slats. Trailing-edge flaps inboard of ailerons, the latter being operated by Jacotet hydraulic boost control units.



The S.E.5000 Baroudeur.

Fuselage.—In two sections, each made up of a keel member, a series of bulkheads and stiffened skin panels. Rear section detachable for access to engine.
Tail Unit.—Cantilever monoplane type with one-piece tailplane mounted near top of fin. Leading-edge sweepback of fin 55°, of tailplane 42°. Tailplane adjustable by two-speed electric jack. Elevators and rudder actuated by Jacotet hydraulic boosters. Electrically-operated trim-tab in rudder.
Landing Gear.—Retractable skids for landing, two main skids forward and one under tail. Skids are of magnesium-alloy with replaceable mild steel shoes. Skids are sprung by rubber blocks in both torsion and compression. Normal take-off by independent trolley which has already been described in introduction.
Power Plant.—One SNECMA Atar 101 axial-flow turbojet engine in fuselage with air inlets in wing roots. Main fuel tanks of self-sealing type in fuselage. Provision for underwing auxiliary or ferrying tanks.
Accommodation.—Pressurised and armoured cockpit forward of wings with sliding and jettisonable canopy. SNCASO ejection seat.
Dimensions.—
Span 10 m. (32 ft. 9½ in.).
Length 13.49 m. (44 ft. 3 in.).
Height (on trolley) 3.600 m. (11 ft. 9½ in.).
Height (on skids) 3.04 m. (10 ft.).
Weights and Performance.—
No data available.

THE SUD-EST AQUILON.

The Aquilon is the French licence version of the de Havilland Sea Venom which is being produced for the French Navy.

Two versions are being built, one a single-seater and the other a two-seater. Both versions are fitted with sliding hoods and SNCASO ejection seats and both are powered by a Ghost 48 Mk. 1 turbojet engine (2,200 kg.=4,840 lb. s.t.).

Armament consists of four 20 mm. cannon plus eight rockets.

The first production Aquilon flew for the first time on March 24, 1954.

Dimensions.—
Span (over tip-tanks) 13.071 m. (42 ft. 10½ in.).
Width folded 7.02 m. (23 ft.).
Length 11.137 m. (36 ft. 6 in.).
Height 2.31 m. (7 ft. 7 in.).
Height (with wings folded) 3.00 m. (9 ft. 10 in.).
Gross wing area 26.0 m.^{2} (280 sq. ft.).
Performance.—
Max. speed at operating height over 900 km.h. (560 m.p.h.).
Service ceiling 15,000 m. (49,200 ft.).

THE S.E. 3130 ALOUETTE II.

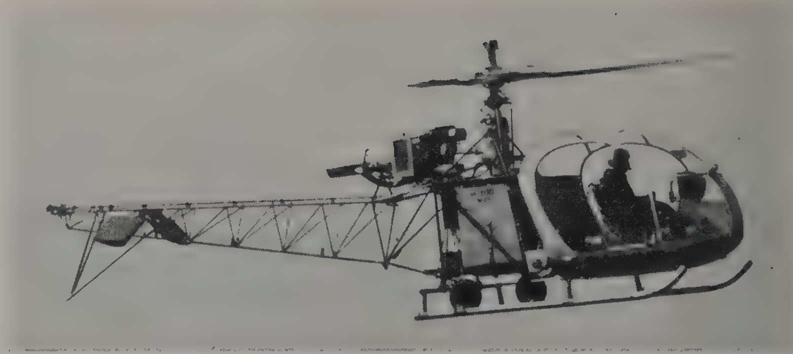
The S.E.3130 Alouette is a 4/5-seat helicopter the rotors of which are driven by a Turbomeca Artouste II shaft turbine. The prototype first flew on March 12, 1955.

The Alouette II is in production for the French Navy.

Type.—Turbine-driven General Purpose Helicopter.
Rotors.—Three-blade main rotor 10 m. (32 ft. 9½ in.) diameter, two-blade anti-torque rotor 1.80 m. (5 ft. 11 in.) diameter. All-metal main rotor blades. Blades on articulated hinges and may be folded towards the rear. Rotor driven through satellete gear-box (16 : 1 reduction), with free wheel for autorotation.
Fuselage.—Glazed cabin has light metal frame, centre and rear fuselage triangulated


The S.E.5000 Baroudeur leaving its trolley on take-off.

steel-tube framework. Rear fuselage detachable for surface transport.
LANDING GEAR.—Skid type with retractable wheels for ground manoeuvring.
POWER PLANT.—One Turbomeca Artouste II shaft turbine developing a max. output of 360 s.h.p. at 5,680 r.p.m. Normal power utilisation 300 s.h.p. at S/L. or 340 equivalent s.h.p. at altitude. Fuel tank (575 litres = 126.5 Imp. gallons) in centre fuselage.
ACCOMMODATION.—Glazed cabin seats pilot and passenger side-by-side in front and two or three passengers behind. Can be adapted for ambulance, rescue, liaison, observation, training, agricultural, photographic and other duties. As an ambulance can accommodate two stretchers and two sitting casualties.
DIMENSIONS.—
Main rotor diameter 10 m. (32 ft. 9½ in.).
Length 9.7 m. (31 ft. 9½ in.).
Height 2.75 m. (9 ft.).
WEIGHTS.—
Weight empty 775 kg. (1,705 lb.).
Disposable load 575 kg. (1,265 lb.).
Normal loaded weight 1,350 kg. (2,970 lb.).
PERFORMANCE.—
Max. speed 180 km.h. (112 m.p.h.).



The S.E. 3130 Alouette II Helicopter (Turbomeca Artouste II shaft turbine).

Cruising speed 170 km.h. (105.5 m.p.h.).
Rate of climb 360 m./min. (1,181 ft./min.).
Service ceiling 4,500 m. (14,760 ft.).
Hovering ceiling with ground effect 3,000 m. (9,840 ft.).
Hovering ceiling without ground effect 1,400 m. (4,590 ft.).
Cruising range 520 km. (323 miles).
Cruising endurance 3 hrs. 15 min.

SUD-OUEST

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU SUD-OUEST (S.N.C.A.S.O.).

HEAD OFFICE: 105, AVENUE RAYMOND-POINCARÉ, PARIS (16e).

WORKS: COURBEVOIE, ROCHEFORT, BOUGUENAIS AND SAINT-NAZAIRE.

President-Director-General: Georges Glasser.

The Société Nationale de Constructions Aéronautiques du Sud-Ouest was formed in 1936 under the Nationalisation Laws. It embraced factories which formerly belonged to the Marcel Bloch, Blériot and Lioré-et-Olivier companies. In 1941 the S.N.C.A. de l'Ouest was merged into the S.N.C.A.S.O., bringing in factories of the former Loire-Nieuport company.

Current Sud-Ouest products include the S.O. 9000, an experimental jet and rocket powered supersonic aircraft, the S.O. 4050 twin-jet monoplane, and the S.O. 1221 compressed-air-driven helicopter without any combustion at the rotor tips. All these aircraft are described and illustrated hereafter.

THE S.O.-30P BRETAGNE.

The S.O.-30P Bretagne is the production version of an aircraft the original design of which began during the war in occupied France. Several prototypes (S.O.-30N, S.O.-30R, etc.) were built and these have been described in previous issues of this Annual.

The S.O.30P is no longer in production. Twenty S.O.30P Bretagnes which became available as the result of the termination of certain airline contracts, or because of the end of hostilities in Indo-China, have been purchased by the French Navy, ten as passenger transports (43 seats in pressurised cabin) and ten as mixed cargo aircraft. The remainder of the S.O.30P's belong to official, civil and military organisations. Two, specially modified as V.I.P. transports, serve as the official air transports for the President of the French Republic and the Prime Minister respectively.

The S.O.-30P has been fitted with three types of power-plant. The standard S.O.-30P-1 has two 2,000 h.p. Pratt & Whitney R-2800-B43 engines and has a certified all-up weight of 18,900 kg. (41,700 lb.). The S.O.-30P-2 has two 2,400 h.p. Pratt & Whitney R-2800-CA18 engines and has a certified all-up weight of 19,500 kg. (43,000 lb.). An S.O.-30P-1 has also been fitted with two Turbomeca Palas auxiliary jet units, and this version has been certified at an all-up weight of 20,150 kg. (44,400 lb.).

One S.O.-30 was fitted experimentally with two Hispano-Suiza Nene turbojet engines and has been used for research and development work in connection with civil jet transports. Another S.O.30, fitted with two SNECMA Atar 101 turbojet engines, is being used by the SNECMA Company as a flying test-bed for jet engines at high altitudes. The S.O.30P-Atar made its first flight on January 27, 1953.

A structural description and specification of the S.O.30P has appeared in previous editions.

THE S.O. 4050 VAUTOUR.

The S.O. 4050 Vautour is a swept-wing twin jet monoplane which has been designed for tactical support, bombing and all-weather fighting.

The first prototype, the S.O. 4050-01, was completed in the two-seat all-weather fighter configuration and was powered by two SNECMA Atar 101B turbojet engines (2,400 kg. = 4,850 lb. s.t. each), which have since been replaced by Atar 101C engines. It made its first flight on October 16, 1952. The second prototype, the S.O. 4050-02, with two Atar 101C turbojets (2,820 kg. = 6,200 lb. s.t. each) flew for the first time on December 16, 1953. This is the prototype for a single-seat ground-support aircraft. The third prototype, the S.O. 4050-03, in the bomber configuration, is powered by two Armstrong Siddeley Sapphire engines. It made its maiden flight on December 5, 1954.

The use of external engine pods below the wings permits the installation of various types of turbojet engines with ratings of up to 4,540 kg. (10,000 lb.) s.t.

The Vautour has been designed to make use of the most modern air-to-air and air-to-ground weapons. As a strategic bomber it can carry an atom bomb over a range of 2,500 km. (1,550 miles) while for its other combat duties provision can be made for the carriage of guided missiles, rockets and other offensive stores, as well as a heavy cannon armament. Depending on the version, the Vautour can be equipped with missile-control or automatic search and lock-on fire-control radar equipment.

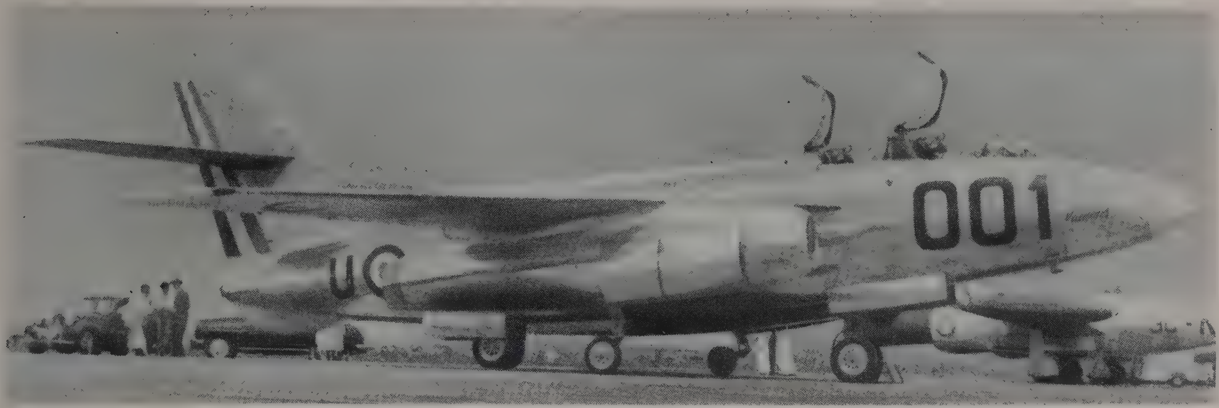
The thin wings and tail surfaces have a sweepback of 35 degrees while the irreversible control system incorporates artificial "feel." The retractable landing-gear is of the tandem dual-wheel type, with small stabilising wheels beneath the engine nacelles.

Metal-to-metal bonding technique, widely used in the construction of the Vautour, is applied to sections of the wing, tailplane, rudder, bomb-bay doors, bomb-hoisting lift, etc.

The crew positions are pressurised and are provided with S.N.C.A.S.O. ejector seats.

The Vautour's speed in level flight ranges over and above 1,100 km.h. (680 m.p.h.) according to power-plant fitted. The first prototype exceeded Mach. 1 in a slight dive at altitude during its

The S.O. 30P Bretagne which is used by the President of the French Republic.



The first prototype S.O. 4050-01 Vautour (two SNECMA Atar 101 turbojet engines).

early trials and was the first French twin-jet aircraft to do so.

With normal load the Vautour can operate from runways measuring less than 800 m. (2,650 ft.) in length. For landing a ribbon-type braking parachute may be used to shorten the run.

A pre-production order for the Vautour was placed by the French Government in 1953 and a production order followed.

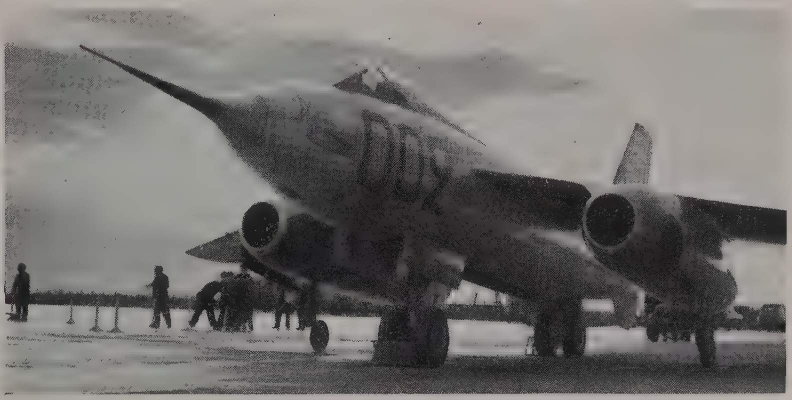
Of the pre-production series, the first aircraft will be the bomber version; the second and fourth aircraft will be tactical support versions; and the third, fifth and sixth will be to the all-weather fighter configuration. The last-mentioned will be powered by two Rolls-Royce Avon engines, whereas the five other versions will be powered by two Atar turbojets.

The first pre-production Vautour was handed over to the French Air Force on March 25, 1955. The remaining five pre-production aircraft will be delivered in 1955.

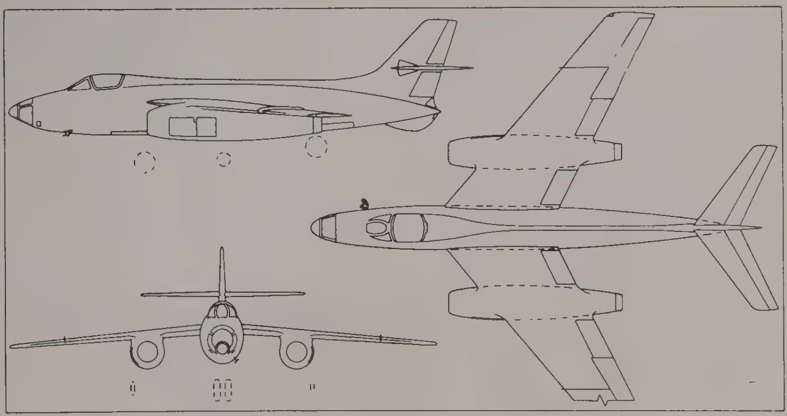
Performance and other detailed characteristics of the Vautour are not available for publication.

THE S.O. 9000 TRIDENT.

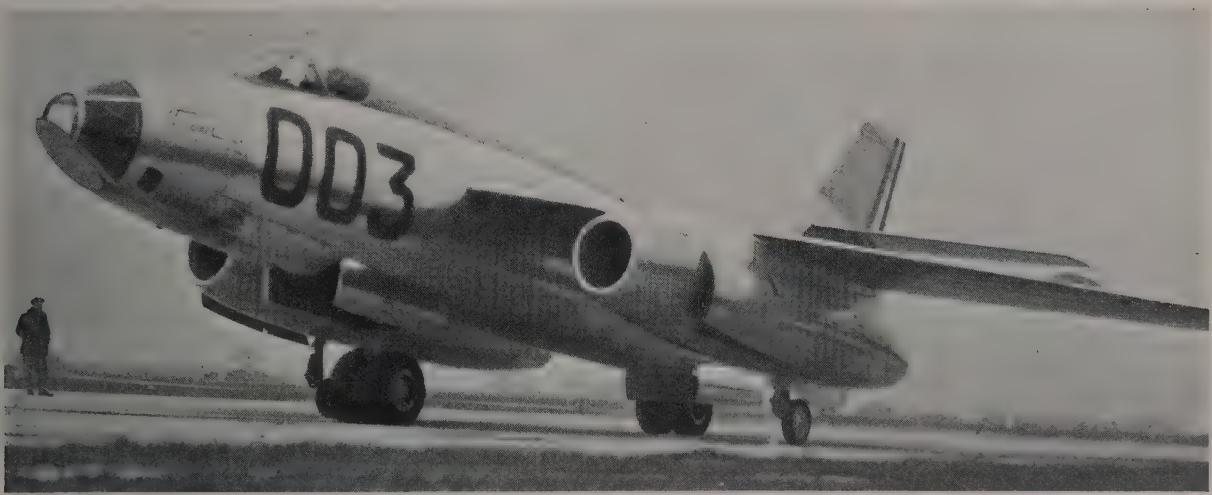
The S.O. 9000 is a single-seat research aircraft which in its ultimate form will be powered by both jet and rocket power-units. For the first stage of testing the aircraft was powered by two Turbomeca Marboré II turbojet engines (400 kg.= 880 lb. s.t. each) mounted at the wing tips, which engines have since been replaced by two Dassault M.D. 30 Viper ASV.5 turbojets (745 kg.=1,640 lb. s.t. each). Later an SEPR 25 rocket motor was installed in the rear fuselage. Thus powered the S.O.9000 has a designed speed of Mach. 1.6 for a duration of 4½ minutes.



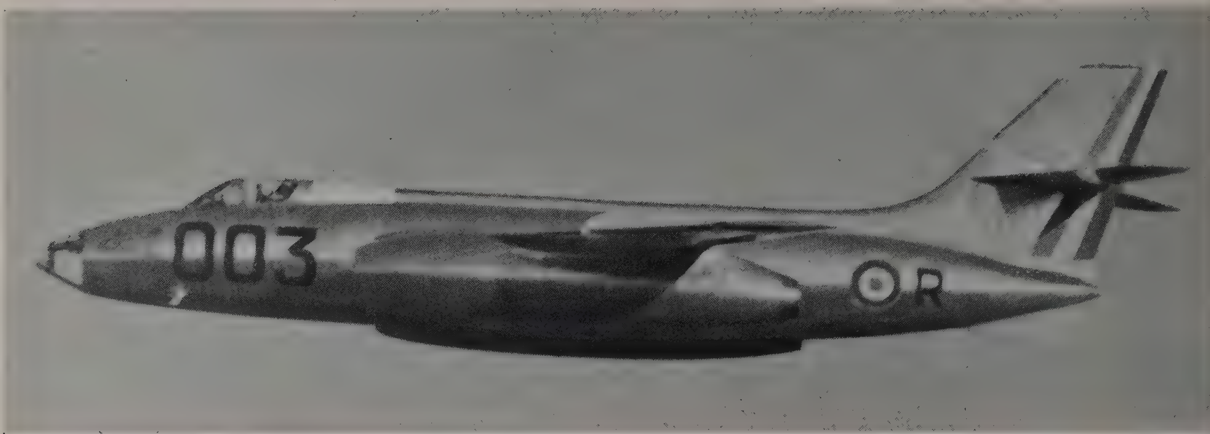
The second prototype S.O. 4050-02 Vautour.



The S.O. 4050-03 Vautour.



The third prototype S.O. 4050-03 Vautour (two Armstrong Siddeley Sapphire turbojet engines).



Another view of the S.O. 4050-03 Vautour (two Armstrong Siddeley Sapphire turbojet engines).

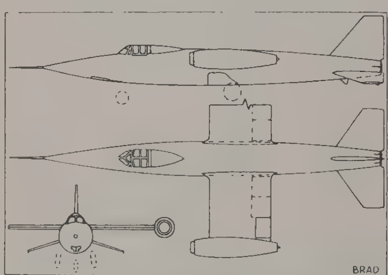
The SEPR.25 rocket motor has an independent turbo-pump unit and three combustion tubes, each of which can be fired separately, or all three together. The turbo pump unit is run on the same liquids (furaline/nitric acid) as used for combustion. The total thrust of the three rocket tubes is 4,500 kg. (9,900 lb.).

The Trident's wings are of thin laminar-flow section, of low aspect ratio and of constant chord. Other features are an anhedral all-moving tail, a tricycle landing gear retracting into the fuselage, air brakes on the rear fuselage, and an ejectable cockpit.

The S.O.9000 powered by its two Marboré wing-tip turbojets only made its maiden flight on March 2, 1953. Its first flight with rocket power was made on September 4, 1954.

The Trident resumed flying with the higher-powered Viper turbojets at the wing-tips early in March, 1955 and shortly after exceeded Mach. 1 by a large margin in a shallow dive without bringing its rocket engine into use.

Tests were then begun under rocket power and a few days later the Trident largely exceeded the speed of sound during the last stage of its climb, using only a fraction of the available rocket power.



The S.O. 9000 Trident.

The S.O. 1221 Djinn Compressed-air-driven Helicopter.

Further tests are underway with a view to obtaining the still higher performance figures which are expected but cannot be disclosed.

THE S.O. 9050.

The S.O.9050 is a derivative of the S.O. 9000 Trident. Two have been ordered by the French Secretariat of State for Air. No further details of this aircraft, the prototype of which flew for the first time on July 21, 1955, were available at the time of writing.

THE S.O. 1221 DJINN.

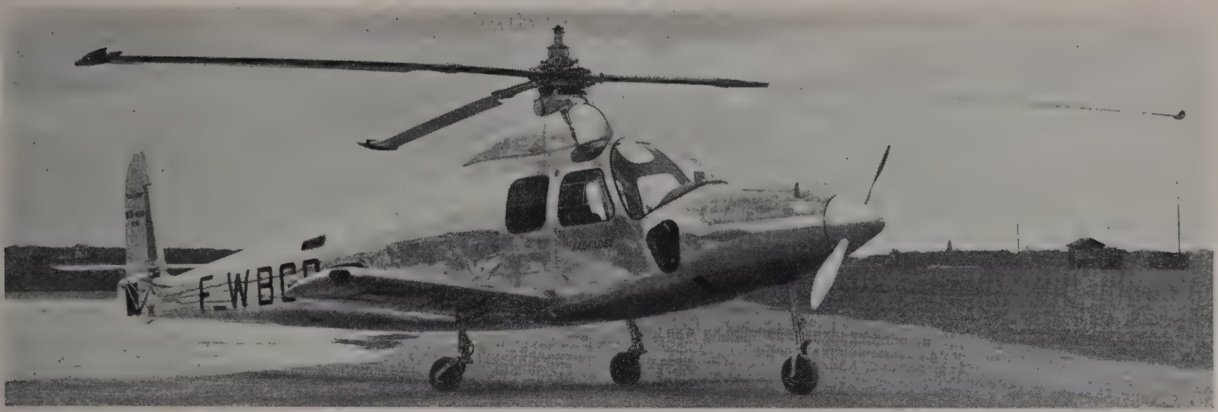
The S.O. 1221 is a two-seat jet turbine-powered helicopter in which the two-blade rotor is driven by compressed air supplied by a Turbomeca Palouste turbo-generator located in the fuselage. Unlike the S.O. 1120, there are no combustion chambers at the rotor blade tips, although the method of feeding the compressed air through the rotor hub and blades to the jet nozzles is similar. The S.O. 1221 most nearly approaches the ram-jet helicopter in simplicity, but its thermodynamic efficiency and its flying qualities, particularly in autorotation, are said to be much superior.

More than 120 Djinn helicopters are being manufactured. First deliveries were made to the French Army in the Summer of 1955.

Type.—Two-seat Jet-driven Helicopter.

Rotor.—Two-blade rotor on tree tilting hub. Light alloy blades attached to blade roots by tensile steel straps which, in turn, are anchored to hub by sealed thrust ball bearings. Compressed air is fed to rotor-tip ejectors through hub, which has a rotating air-sealed joint, and ducts in blade leading-edges. Total disc area 78.5 m.² (845 sq. ft.).

The S.O. 9000 Trident Single-seat High-speed Research Monoplane (two wing-tip-mounted Turbomeca Marboré II turbojet engines and one SEPR rocket motor in rear fuselage).



The S.O. 1310 Farfadet Gyrodyne with nose-mounted turboprop and jet-driven-rotor.

FUSELAGE.—Steel tube structure.

LANDING GEAR.—Skid type.

POWER PLANT.—One 250 h.p. Turbomeca Palouste turbo generator in fuselage supplies compressed air through trunk to rotor hub and blade ducts to rotor-tip ejectors. Fuel tank in fuselage. Fuel capacity 246 litres (54 Imp. gallons). Oil capacity 9.45 litres (2 Imp. gallons).

ACCOMMODATION.—Front of fuselage enclosed by transparent panels. Can accommodate pilot and passenger or pilot and two stretcher cases.

DIMENSIONS.—
- Rotor diameter 10 m. (32 ft. 10 in.).
- Length of fuselage 5.30 m. (17 ft. 4 in.).
- Width of fuselage 1.90 m. (6 ft. 2 in.).
- Height (to top of rotor pylon) 2.36 m. (7 ft. 9 in.).

WEIGHTS.—
- Weight empty 310 kg. (684 lb.).
- Disposable load 320 kg. (706 lb.).
- Normal loaded weight 630 kg. (1,390 lb.).
- Max. weight for vertical take-off 715 kg. (1,550 lb.).

PERFORMANCE (at normal loaded weight).—
- Max. speed 130 km.h. (81 m.p.h.).
- Cruising speed for max. range 100 km.h. (62 m.p.h.).
- Cruising speed for max. endurance 60 km.h. (37 m.p.h.).
- Service ceiling 3,000 m. (9,840 ft.).
- Range and duration (single-seater with radio) 220 km. (135 miles) or 2½ hrs.
- Range and duration (two-seat with radio) 140 km. (87 miles) or 1 hr. 35 min.
- Range and duration (pilot and two stretchers) 40 km. (25 miles) or 25 min.
- Duration (single-seater with 190 kg. = 420 lb.) of spraying or dusting equipment) 30 min.

THE S.O. 1310 FARFADET.

The S.O. 1310 is the first French aircraft of the gyrodyne type, that is, one which is able to take-off vertically, hover and land vertically in the manner of a helicopter by means of its rotor, and which may also fly forward at a speed greater than that of the normal helicopter by means of a fixed wing and a propeller which is independent of the rotor. With the S.O. 1310 the translation from rotary-wing to fixed-wing flight is accomplished without any change in the exterior configuration. During forward flight the rotor continues to turn in autorotation at low lift while the fixed wing provides the primary lift.

The S.O. 1310 is also novel in that power is provided by two independent gas-turbine units, a 360 h.p. Turbomeca Arius II turbo-compressor, located in the fuselage aft of the cabin, which supplies compressed air to the jet-driven rotor, and a 360 h.p. Turbomeca Artouste II turboprop engine which drives a variable-pitch tractor airscrew in the nose of the fuselage. The all-metal three-blade jet-driven rotor is similar to that fitted to the S.O. 1120 Ariel III with small combustion chambers at the rotor tips. The rotor has a diameter of 11.20 m. (36 ft. 8½ in.).

The fixed wing has a span of 6.30 m. (20 ft. 8 in.) and is used as a fuel tank.

The enclosed cabin has accommodation for a crew of two seated side-by-side with dual controls, and either three passengers, two stretcher cases or freight.

The Farfadet first flew as a helicopter on May 8, 1953, and first achieved compound flight on July 1, 1953.

HUNGARY

When the war ended no aircraft manufacturing facilities remained in Hungary. The German armies dismantled and removed all plant and equipment when it evacuated the country.

In recent years the Országos Magyar Repülö Egyesület (National Hungarian Aeronautical Association) has played a part in the encouragement of the manufacture of light aircraft of national design, the most important constructional establishment being the Sportarutermelö N.V., or national concern for the production of sporting equipment, which has an aircraft factory at Esztergom.

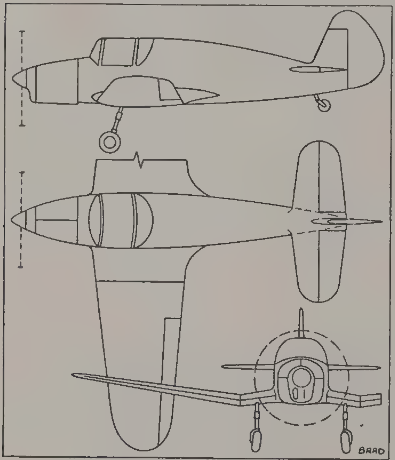
This factory builds light aircraft and gliders to the designs of Engineer Ernö Rubik. Among the principal Rubik designs are the R.14 Pinty (Finch), the R.15 Koma (Godfather) and R.16 Lepke (Butterfly), the last two being training gliders, the R.17 Móka (Joy) aerobatic sailplane, the R.18 Kánya (Kite) glider-tug and the R.22 Futár (Courier) sailplane.

Other current designs are the M.30 Fergeteg sailplane, the SG.2 Kék Madár (Blue Bird) two-seat light monoplane designed by Samu and Geönczy; the Botond two-seat trainer designed by Nagy and Cserkuti; the Nádi training glider designed by Nagy; the Bene training glider designed by Nagy in collaboration with Bansagi; the Pajtás (Comrade) designed by Lampich; and the Lurko designed by Burodics.

The most recent sailplane designs are the OE-01, the Junius 18 and the all-metal Györ II which has a fineness ratio of 42.85.

THE SG.2 KÉK MADÁR (BLUE BIRD).

Type.—Two-seat Trainer or Tourer.
Wings.—Low gull-wing cantilever monoplane. All-wood structure.



The SG 2 Kék Madár.

Fuselage.—Rectangular section all-wood structure with domed decking.
Tail Unit.—Cantilever monoplane type.
Landing Gear.—Fixed type. Cantilever oleo shock struts. Fixed tail-wheel.
Power Plant.—One 105 h.p. Hirth HM 504A four-cylinder inverted air-cooled engine.
Accommodation.—Enclosed cabin seating two side-by-side with dual controls.
Dimensions.—
Span 9.50 m. (31 ft. 2 in.).
Length 7.50 m. (25 ft. 7 in.).
Height 2.10 m. (6 ft. 11 in.).
Weights.—
No data.
Performance.—
Max. speed 220 km.h. (136 m.p.h.).
Cruising speed 175 km.h. (108.7 m.p.h.).

THE R.18 KANYA (KITE).

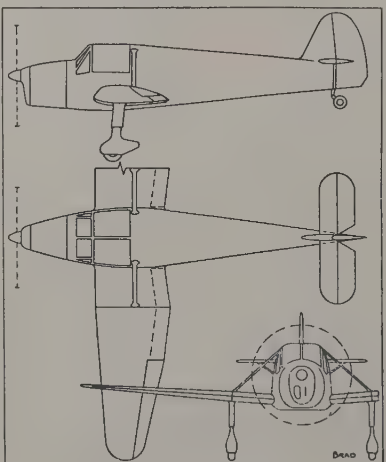
Type.—Single-engined Glider-tug.
Wings.—High-wing braced monoplane. Vee bracing struts. Fixed leading-edge slots and retractable camber-changing flaps. Gross wing area 14 m.² (151 sq. ft.).
Fuselage.—Oval section structure of mixed construction.
Tail Unit.—Braced monoplane type.
Landing Gear.—Fixed divided type. Long-stroke oleo legs with upper ends attached to upper fuselage longerons and the lower ends hinged to the lower longerons by Vee struts. Fixed tail-wheel.
Power Plant (Prototype).—One 130 h.p. Walter Major 4-I four-cylinder in-line inverted air-cooled engine. Production aircraft have the 160 h.p. Walter Minor 6-III six-cylinder engine.
Accommodation.—Cabin seating two side-by-side, with optional third seat behind.
Dimensions.—
Span 1.6 m. (38 ft.).
Length (prototype) 7.5 m. (24 ft. 7 in.).
Length (production) 7.7 m. (25 ft. 3 in.).
Height (tail up) 2.08 m. (6 ft. 10 in.).
Weights.—
Weight empty 410 kg. (905 lb.).
Weight loaded 690 kg. (1,520 lb.).
Performance (130 h.p. Walter Major 4-I engine).—
Max. speed 175 km.h. (108.6 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Economic cruising speed 150 km.h. (93 m.p.h.).
Glider towing speed 80-100 km.h. (50-62 m.p.h.).
Rate of climb 300 m./min. (984 ft./min.).
Rate of climb with glider in tow 270 m./min. (886 ft./min.).
Service ceiling 6,000 m. (19,680 ft.).
Range 600 km. (372 miles).
Take-off run (no wind) 96 m. (104 yds.).

THE DARÚ (CRANE).

Type.—Two/three-seat Tourer, Trainer or Glider-tug.
Wings.—High-wing braced monoplane. Vee bracing struts. Fixed leading-edge slots and retractable flaps.
Fuselage.—Similar to R.18.
Tail Unit.—Braced in monoplane type.
Landing Gear.—Fixed divided type. Consists of two side vees incorporating oleo springing, and two half axles, the inner ends of which are hinged to the centre-line of the underside of the fuselage. Fixed tail-wheel.
Power Plant.—One 130 h.p. Hirth or 120/130 h.p. Walter Major 4-I four-cylinder in-line inverted air-cooled engine.
Accommodation.—Enclosed cabin seating two side-by-side with optional third seat behind. Latter not fitted when aircraft is used as a glider-tug.
Dimensions.—
Same as for R.18 Kanya except:
Span 10 m. (32 ft. 9 in.).
Weights.—
No data available.
Performance.—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Min. speed with glider on tow 50-55 km.h. (31-34 m.p.h.).

THE BOTOND.

Type.—Two-seat Trainer.
Wings.—Low-wing semi-cantilever monoplane. Entire trailing-edge hinged, with two-piece flaps inboard of ailerons.
Fuselage.—All-wood structure.
Tail Unit.—Braced monoplane type.
Landing Gear.—Fixed type. Cantilever oleo legs and wheel fairings. Fixed tail-wheel.
Power Plant.—One 105 h.p. Hirth HM 504A four-cylinder in-line inverted air-cooled engine.

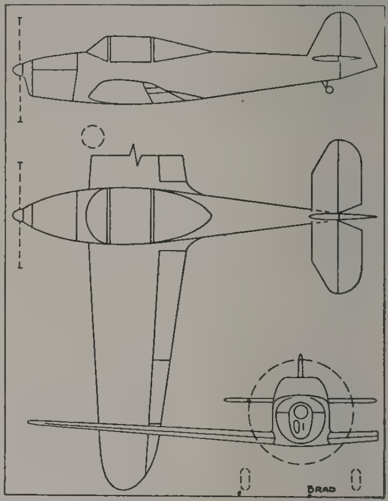


The Botond Trainer.

Accommodation.—Enclosed cabin seating two side-by-side with dual controls.
Dimensions.—
Span 9.5 m. (31 ft. 2 in.).
Length 8.2 m. (26 ft. 11 in.).
Height (tail down) 1.9 m. (6 ft. 3 in.).
Weights and Performance.—
No data available.

THE PAJTÁS (COMRADE).

Type.—Two-seat Advanced Trainer.
Wings.—Low-wing cantilever monoplane.

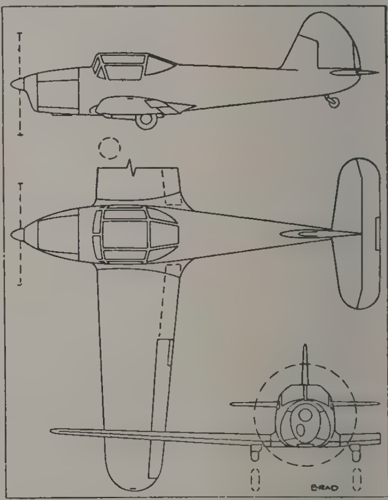


The Pajtás Trainer.

Entire trailing-edge hinged, outer sections as ailerons and inner sections as flaps.
Fuselage.—Rectangular section structure.
Tail Unit.—Cantilever monoplane type.
Landing Gear.—May be either fixed or retractable, although retractable gear normally fitted. Fixed tail-wheel.
Power Plant.—One 105 h.p. Hirth HM 504A four-cylinder in-line inverted air-cooled engine.
Accommodation.—Enclosed cabin seating two side-by-side with dual controls.
Dimensions.—
Span about 10 m. (32 ft. 10 in.).
Weights and Performance.—
No data available.

THE LURKÓ (ROGUE).

Type.—Two-seat Trainer.
Wings.—Low-wing cantilever monoplane.
Fuselage.—All-wood rectangular structure.



The Lurkó Trainer.

Tail Unit.—Cantilever monoplane type.
Landing Gear.—Retractable type. Fixed tail-wheel.
Power Plant.—One 105 h.p. Hirth HM 504A four-cylinder in-line inverted air-cooled engine.
Accommodation.—Enclosed cabin seating two side-by-side with dual controls.
Dimensions, Weights and Performance.—
No data available.

INDONESIA

ANGKATAN UDARA REPUBLIK INDONESIA, STAF TEKNIK, DEPOT PERAWATAN TEKNIK UDARA, SEKSI PERTJOBAAN (Indonesian Air Force, Technical Staff, Aircraft Maintenance Depot, Experimental Section).

ADDRESS: HUSEIN SASTRANAGARA AIR FORCE BASE, BANDUNG, JAVA.

Director: Major Nurtanio Pringgoadisuryo, B.Sc.(Ae.).

This is now the only facility in Indonesia which is building aircraft.

In 1946 Major Nurtanio designed and built a batch of six gliders of the "Zögling" type. These were built entirely of Indonesian materials, the import of foreign materials being impossible at that time. These gliders have served successfully as trainers for the pre-engined flight selection of Air Force cadets.

In 1947 Air Vice-Commodore Wiweko Supono designed and built the WEL-1 single-seat parasol monoplane powered by a 28 h.p. Harley-Davidson motorcycle engine. In spite of the difficulty of obtaining materials, the construction of this aircraft took only five months from the drawing board to the first test flight.

Both these types were built in the Air Force workshops at the Maospati Air Force Base, Madiun, Java.

In 1950 the Indonesian Air Force took over the former workshops of the Netherlands Indies Army Air Service in Bandung, Java.

In 1953 Major Nurtanio Pringgoadisuryo began the design of the NU-200 Sikumbang. The prototype made its first flight on August 1, 1954.

As the result of early tests with the NU-200 several modifications have been made. The canopy has been slightly lowered, the upper engine cowling has been improved in shape and fairings have been added to the main wheels. Other modifications being incorporated include the fitting of statically-balanced ailerons and a statically and dynamically balanced elevator, mechanically-operated flaps instead of electric, and a steerable nose-wheel instead of fixed. It is planned to instal a more up-to-date engine, probably a 225 h.p. Continental, in the production version.

The prototype NU-200 Sikumbang (200 h.p. D.H. Gipsy-Six engine).

THE NU-200 SIKUMBANG (BEE).

TYPE.—Single-seat light Ground Support monoplane.

WINGS.—Low-wing cantilever monoplane. Aerofoil section NACA 23015 at root, NACA 23009 at tip. Aspect ratio 6.6. Dihedral 5°. Incidence 4.5°. One-piece two-spar all-wood construction with plywood covering. Electrically-operated all-wood plywood covered landing flaps. Frise-type all-wood plywood covered ailerons. Total area of ailerons 22.4 sq. ft. (2.08 m.²). Total area of flaps 15.5 sq. ft. (1.40 m.²). Gross wing area 182 sq. ft. (16.9 m.²).

FUSELAGE.—Welded steel-tube structure with metal covering.

TAIL UNIT.—Cantilever all-wood plywood covered monoplane type. Fin mounted forward of tailplane. Trim-tabs in rudder and elevator. Areas: fin 9.9 sq. ft. (0.92 m.²), rudder 8.7 sq. ft. (0.80 m.²), tailplane 19.2 sq. ft. (1.78 m.²), elevators 16.8 sq. ft. (1.56 m.²). Span of tailplane 11 ft. 2½ in. 3.42 m.).

LANDING GEAR.—Fixed nose-wheel type. Cantilever oleo shock-absorber struts. Non-steerable nose-wheel. Track 10 ft. (3.05 m.).

POWER PLANT.—One 200 h.p. D.H. Gipsy-Six Series 1 six-cylinder in-line inverted air-cooled engine. Two-blade fixed-pitch wooden airscrew. One fuel tank in each wing root (16 Imp. gal.=73 litres each) and one tank (13 Imp. gal.=59 litres) in fuselage behind pilot's seat. Total fuel capacity 45 Imp. gallons (205 litres).

ACCOMMODATION.—Single cockpit with sliding canopy.

ARMAMENT.—No data available.

DIMENSIONS.—
Span 34 ft. 9½ in. (10.61 m.).
Length 26 ft. 9 in. (8.16 m.).
Height 11 ft. (3.35 m.).

WEIGHTS.—
Weight empty 1,750 lb. (795 kg.).
Weight loaded 2,400 lb. (1,090 kg.).

PERFORMANCE.—
Max. speed at S/L. 160 m.p.h. (256 km.h.).
Cruising speed at S/L. 140 m.p.h. (224 km.h.).
Landing speed 55 m.p.h. (88 km.h.).
Initial rate of climb over 1,000 ft./min. (305 m./min.).
Service ceiling 16,500 ft. (5,030 m.).
Range 600 miles (960 km.).

The prototype NU-200 Sikumbang Single-seat Ground Support Monoplane (200 h.p. D.H. Gipsy-Six engine).

ITALY

AGUSTA

COSTRUZIONI AERONAUTICHE GIOVANNI AGUSTA.

HEAD OFFICE: CASCINA COSTA, GALLARATE.

President: Countess Giuseppina Turretta Agusta.

General Manager: Comm. Domenico Agusta.

Deputy General Manager: Dr. Mario Agusta.

This company, in spite of post-war difficulties, has succeeded in re-establishing itself in the aircraft manufacturing field.

In 1952 Agusta obtained the exclusive manufacturing rights for the Bell Model 47 helicopter and series production has now begun. The first Agusta-built Model 47G made its maiden flight on May 22, 1954.

A first order of ten Model 47's was delivered to the Italian Air Force in 1954-55, and others have been supplied to various Italian and foreign customers. Of particular importance is the substantial order which has been placed by the French Air Force.

Agusta is also licenced to manufacture all spare parts for Bell helicopters for the whole of Europe.

Ing. Filippo Zappata has prepared for Agusta various designs for transport aircraft for both civil and military purposes, and the company has submitted a proposal for a twin-engined transport to the Italian Air Force. A four-engined transport to be powered by four Alvis Leonides engines is also planned both as a economical civil transport for passengers and freight and as a military transport.

Agusta is also operating a repair and overhaul organisation, mainly for the Italian Government.

AMBROSINI

SOCIETA AERONAUTICA ITALIANA, ING. A. AMBROSINI & C.

REGISTERED OFFICE: VIA PALESTRO 68, ROME.

HEAD OFFICE: VIALE MAINO 23, MILAN.

AIRCRAFT WORKS: PASSIGNANO SUL TRASIMENO (PERUGIA).

AERODROME: CASTIGLIONE DEL LAGO.

Chairman and Managing Director: Ing. Angelo Ambrosini.

Aircraft Designer: Ing. Sergio Stefanutti.

The Societa Aeronautica Italiana was incorporated into the Ambrosini group in 1934. Since that time a long series of touring and training aircraft have been designed and built.

The company's first post-war type was the S.1001 Grifo four-seat touring and training monoplane. This was followed by a two-seat primary trainer development of the Grifo known as the S.1002 Trasimenus. Both these aircraft have been fully described and illustrated in previous editions of "All the World's Aircraft."

The latest and most important product of the company is the S.7 military trainer which may be equipped as either a single-seater or a two-seater. This aircraft which has been ordered in a small series by the Italian Air Force, is described hereafter.

From the S.7 has been evolved the slightly larger and more powerful Super S.7. This aircraft is described hereunder.

The Ambrosini Super S.7 (380 h.p. D.H. Gipsy Queen 70 engine).

THE AMBROSINI SUPER S.7.

The Super S.7 is a slightly larger and more powerful version of the S.7 and has been designed to provide all training requirements up to the stage where pilots are qualified to join operational jet training units.

The general configuration and structure of the Super S.7 are same as for the S.7. The following particulars apply only to the Super S.7.

TYPE.—Two-seat Military Trainer.

WINGS.—As for S.7. Aspect ratio 6.2. Mean chord 1.40 m. (4 ft. 7 in.). Aerodynamic air-brakes between ailerons and flaps. Wing area 13.8 m.² (148.5 sq. ft.).

POWER PLANT.—One 380 h.p. D.H. Gipsy Queen Series 70 six-cylinder in-line inverted air-cooled geared and supercharged engine. Three-blade D.H. constant-speed airscrew. Alternatively, the 400 h.p. Alfa 121C eight-cylinder inverted Vee air-cooled geared and supercharged engine driving an SIAI Marchetti constant-speed airscrew may be fitted. Petal-type cowling with flush-type fasteners. When open the four panels of the cowling expose the entire power-plant. Five fuel tanks with total capacity for 220 litres (48.4 Imp. gallons).

ACCOMMODATION.—Enclosed cockpit for two in tandem with dual controls. Canopy in four parts consisting of windshield, front sliding canopy, a middle section and rear sliding canopy. Actuator for opening front canopy mechanically lowers the middle section sufficiently before canopy slides aft. Equipment: complete instrumentation for navigation, night flying, etc. Oxygen equipment. ETR 9-X VHF 10-channel transmitter and receiver, radio range receiver, Lear automatic D/F.

ARMAMENT.—One 7.7 mm. SAFAT machine-gun in port wing. Camera-gun in starboard wing. Racks for two 45-kg. and two 14-kg. bombs and rails for four rockets. Remotely-operated F.24 camera.

DIMENSIONS.—
- Span 9.3 m. (30 ft. 6 in.).

WEIGHTS AND LOADINGS.—
- Weight empty 1,376 kg. (3,030 lb.).
- Crew (2) 170 kg. (375 lb.).
- Military load 229 kg. (505 lb.).
- Fuel and oil 177 kg. (390 lb.).
- Weight loaded 1,952 kg. (4,300 lb.).
- Wing loading 140 kg./m.² (28.7 lb./sq. ft.).
- Power loading 5.76 kg./h.p. (12.7 lb./h.p.).

PERFORMANCE (D.H. Gipsy Queen 70 engine).—
- Max. speed at S/L. 392 km.h. (245 m.p.h.).
- Max. speed at 2,000 m. (6,560 ft.) 427 km.h. (267 m.p.h.).
- Economic cruising speed 280 km.h. (175 m.p.h.).
- Landing speed (flaps down) 120 km.h. (75 m.p.h.).
- Stalling speed (clean) 128 km.h. (80 m.p.h.).
- Climb to 5,000 m. (16,400 ft.) 21 min.
- Service ceiling 7,625 m. (23,000 ft.).
- Cruising endurance 4 hours.

PERFORMANCE (Alfa 121C engine).—
- Max. speed 460 km.h. (285.6 m.p.h.) at 3,000 m. (9,840 ft.).
- Climb to 5,000 m. (16,400 ft.) 18 min.
- Service ceiling 7,500 m. (24,600 ft.).
- Cruising range 1,100 km. (683 miles).
- Cruising endurance 3 hr. 50 min.

THE AMBROSINI S.7.

TYPE.—Single or Two-seat Military Trainer.

WINGS.—Low-wing cantilever monoplane in one piece. NACA 2200 Series wing section with maximum root thickness of 12%. All-wood two-spar structure with plywood skin. Statically and aerodynamically-balanced ailerons. Hydraulically-operated trailing-edge flaps. Gross wing area 12.80 m.² (137.8 sq. ft.).

FUSELAGE.—Oval section wood monocoque.

TAIL UNIT.—Cantilever monoplane type. Fin integral with fuselage. Single-piece two-spar plywood-covered tailplane, the incidence of which is adjustable in flight. Movable surfaces have tubular spars, wood ribs and fabric covering.

LANDING GEAR.—Retractable tail-wheel type. Oleo-pneumatic shock-struts. Hydraulic retraction with emergency hand pump. Messier or Magnaghi hydraulic wheel-brakes. Non-retracting tail-wheel has Dowty shock-absorber.

POWER PLANT.—One 225 h.p. Alfa 115*ter* six-cylinder in-line inverted air-cooled engine driving a Fiat-Hamilton or Piaggio two-blade constant-speed airscrew. Fuel system includes three wing tanks with total capacity of 114 litres (25 Imp. gallons) and one fuselage tank with a capacity of 14 litres (3.3 Imp. gallons) in single-seater, or 77 litres (17 Imp. gallons) in two-seater. Provision for installation of a 250 h.p. D.H. Gipsy Queen 30 Series engine in place of Alfa 115*ter*.

ACCOMMODATION.—Enclosed cockpit for one or two, latter with dual controls. Canopies hinge sideways and may be jettisoned in emergency.

The Ambrosini Super S.7 (400 h.p. Alfa 121C engine).

EQUIPMENT (Single-seater).—Radio equipment includes SCR.522A VHF receiver and transmitter and BC.1206A LF receiver. F.24 camera. 7.7 mm. SAFAT belt-fed machine-gun in port wing outside airscrew disc.

EQUIPMENT (Two-seater).—Western SCR.27 short-wave radio including two receivers on different wave-lengths and one transmitter. Blind-flying equipment.

EQUIPMENT (common to both versions).—Full night-flying equipment, including landing-light on port landing-gear shock-strut. CO.2 fire-extinguishing system.

DIMENSIONS.—
Span 8.79 m. (28 ft. 10 in.).
Length 8.17 m. (26 ft. 10 in.).
Height 2.80 m. (9 ft.).

WEIGHTS AND LOADINGS (225 h.p. Alfa 115*ter* engine).—
Weight empty 1,074 kg. (2,365 lb.).
Disposable load 302 kg. (665 lb.).
Weight loaded 1,376 kg. (3,030 lb.).
Wing loading 107.36 kg./m.^{2} (22 lb./sq. ft.).
Power loading 6.40 kg./h.p. (14.1 lb./h.p.).

WEIGHTS AND LOADINGS (250 h.p. D.H. Gipsy Queen 30 engine).—
Weight empty 1,140 kg. (2,512 lb.).
Disposable load 310 kg. (683 lb.).
Weight loaded 1,450 kg. (3,195 lb.).
Wing loading 113.12 kg./m.^{2} (23.18 lb./sq. ft.).
Power loading 5.81 kg./h.p. (12.8 lb./h.p.).

The Ambrosini S.7 Two-seat Military Trainer (225 h.p. Alfa 115*ter* engine).

The Ambrosini S.7 Single-seat Trainer (225 h.p. Alfa 115*ter* engine).

PERFORMANCE (225 h.p. Alfa 115*ter* engine).—
Max. speed 358 km.h. (224 m.p.h.) at S/L.
Cruising speed 264 km.h. (165 m.p.h.) at 900 m. (2,950 ft.).
Stalling speed 114.4 km.h. (71.5 m.p.h.).
Initial rate of climb 336 m./min. (1,103 ft./min.).
Service ceiling 5,250 m. (1,7220 ft.).
Take-off run 250 m. (273 yds.).
Landing run 220 m. (241 yds.).

PERFORMANCE (250 h.p. D.H. Gipsy Queen 30 engine).—
Max. speed 370 km.h. (230 m.p.h.).
Stalling speed 117.2 km.h. (73.3 m.p.h.).
Initial rate of climb 426 m./min. (1,396 ft./min.)
Service ceiling 5,720 m. (18,700 ft.).
Take-off run 225 m. (245 yds.).
Landing run 235 m. (257 yds.).

THE AMBROSINI F.7 RONDONE.

TYPE.—Three/four-seat Light Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 6.60. All-wood one-piece single-spar structure, plywood covering. Differentially-controlled ailerons. Two-position flaps, 15° for take-off and 45° for landing. Gross wing area 10.60 m. (114 sq. ft.).

FUSELAGE.—All-wood monocoque structure in two sections, the forward section integral with wing.

TAIL UNIT.—Cantilever monoplane type. All-wood structure, fixed surface covered with plywood, rudder and elevators covered with fabric. Controllable trim-tab in elevator.

LANDING GEAR.—Retractable tricycle type. Manual actuation, but electric actuator may be installed on demand. Oleo-pneumatic shock-absorber struts. Hydraulic wheel brakes.

POWER PLANT.—One 90 h.p. Continental C90 four-cylinder horizontally-opposed air-cooled engine. Two-blade Aeromatic automatic variable-pitch airscrew. Alternatively, the 125-135 h.p. Lycoming engine or any other engine of similar power can be fitted. These would drive a two-blade fixed-pitch airscrew. Three fuel tanks, two in front of instrument board and one behind passenger seat. Total capacity 142 litres (31 Imp. gallons).

ACCOMMODATION.—Enclosed cockpit seating three, side-by-side with dual controls and one in seat behind pilot on port side, leaving space for baggage on starboard side. If 125-135 h.p. engine installed a bench-type seat for two can be fitted at back of cabin. Full instrument equipment, VHF 12-channel transmitter and receiver, night-flying lighting, etc.

DIMENSIONS.
Span 9.30 m. (30 ft. 6 in.).
Length 6.80 m. (22 ft. 4 in.).

WEIGHTS AND LOADINGS (3-seater—90 h.p. Continental C90 engine).—
Weight empty 480 kg. (1,056 lb.).
Pilot and 2 passengers 225 kg. (495 lb.).
Fuel and oil 55 kg. (110 lb.).
Baggage 10 kg. (22 lb.).
Weight loaded 770 kg. (1,694 lb.).
Wing loading 58.5 kg./m.^{2} (12.0 lb./sq. ft.).
Power loading 6.8 kg./h.p. (14.9 lb./h.p.).

WEIGHTS AND LOADINGS (4-seater—125 h.p. Lycoming engine).—
Weight empty 530 kg, (1,166 lb.).
Pilot and 3 passengers 300 kg. (660 lb.).
Fuel and oil 70 kg. (154 lb.).
Weight loaded 900 kg. (1,980 lb.).
Wing loading 68 kg./m.^{2} (13.9 lb./sq. ft.).
Power loading 9.5 kg./h.p. (20.9 lb./h.p.).

PERFORMANCE (90 h.p. Continental C90 engine).—
Max. speed 235 km.h. (150 m.p.h.).
Min. speed 70 km.h. (43.5 m.p.h.).
Ceiling 3,800 m. (12,460 ft.).
Range (3-seater) 650 km. (405 miles).
Take-off run 150 m. (164 yds.).
Landing run 85 m. (93 yds.).

PERFORMANCE (125 h.p. Lycoming engine).—
Max. speed 265 km.h. (165 m.p.h.).
Min. speed 75 km.h. (46.5 m.p.h.).
Ceiling 4,500 m. (14,760 ft.).
Range (4-seater) 700 km. (435 miles).
Take-off run 130 m. (142 yds.).
Landing run 100 m. (109 yds.).

The Ambrosini F.7 Rondone (90 h.p. Continental C90 engine).

FIAT

SOCIETÀ PER AZIONI FIAT.

HEAD OFFICE: CORSO 4 NOVEMBRE 300, TURIN.

Chairman: Prof. Vittorio Valletta.

Director-General: Ing. Gaudenzio Bono.

Chief of Aeronautical Design and Engineering Department: Ing. Giuseppe Gabrielli.

The following branches of the Fiat organization are concerned with the manufacture of aircraft and aero-engines:—

FIAT—SEZIONE AERITALIA.

WORKS: CORSO FRANCIA 366, TURIN.

Director: Ing. Galli Bartolomeo.

Engaged in the construction of aircraft and airscrews.

SOCIETA ANONIMA COSTRUZIONI MECCANICHE AERONAUTICHE (C.M.A.S.A.).

WORKS: MARINA DI PISA.

Normally concerned with the manufacture of flying-boats.

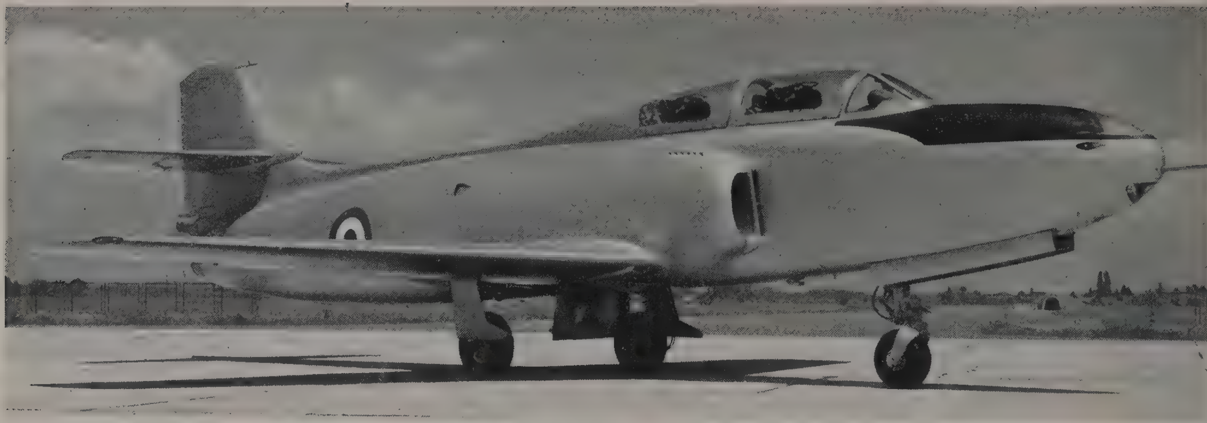
FIAT—SEZIONE MOTORI AVIAZIONE.

WORKS: VIA NIZZA 250, TURIN.

(See Aero-Engine Section).

The direction and technical and commercial departments of the central organization co-ordinates the activities of the three above-mentioned branches, all of which have their own managerial staff.

The Fiat company has made considerable progress in re-establishing itself since the war in the aircraft field. Over 300 G.46's have been built for the Italian



The Fiat G.80-3B Fighter Trainer (D.H. Goblin 35 turbojet engine).

and Argentine air forces and a smaller number of G.59's for the Italian Air Force and certain foreign air forces. The latest design of advanced trainer is the G.49, the two prototypes of which were built with different engines and are now in production.

Fiat is now engaged in the production of jet-propelled aircraft. Apart from manufacturing the de Havilland Vampire 52 and Venom wings under licence, the company has designed and built the G.80 two-seat jet-propelled trainer, which is now in production in the versions G.80-1B, G.80-3B and G.82.

Under an agreement concluded in 1953 between the Italian Government, Fiat and North American Aviation, Inc. Fiat is building the North American F-86K all-weather interceptor fighter. The first Fiat-built F-86K was completed and flown in June, 1955. This was the first of an off-shore contract for 120 placed by the U.S.A.F. for allocation to certain N.A.T.O. air forces. The first aircraft of this order are being delivered to the Italian Air Force.

THE FIAT G.91.

The G.91 is a light ground attack fighter which was designed in accordance with NATO operational requirements for a lightweight tactical strike fighter for the ground attack rôle which were issued in the Spring of 1954 to the aircraft manufacturers of Western Europe. In the initial evaluation of the designs submitted the Fiat G.91 was one of the two out of eight projects which were recommended for construction.

Fiat has now been awarded a contract for the construction of three prototypes and twenty-seven pre-production aircraft and, subject to satisfactory field service trials, will be ordered into series production for N.A.T.O. air forces.

The G.91 is an all-metal swept-wing monoplane which will be powered by a Bristol Orpheus lightweight turbojet engine which in its initial form achieved a thrust of 3,285 lb. (1,490 kg.) on its first 150-hour type-test. Other versions are already running at higher powers.

No further details of the G.91 were available for publication at the time of closing for press.

THE FIAT G.80.

The G.80 is a two-seat jet fighter trainer and exists in the following versions:—

G.80-1B. Powered with a D.H. Goblin 35 turbojet engine. Prototype. First flew on December 10, 1951.

G.80-3B. Production version of the above, fully equipped for day and night training.

Type.—Two-seat Fighter Trainer.

Wings.—Low-wing cantilever monoplane. Aspect ratio 4.82. Laminar-flow wing-section. All-metal two-spar structure with swept-back leading-edge and straight trailing-edge. Split flaps inboard of ailerons. Wing area 25 m.² (270.6 sq. ft.).

Fuselage.—All-metal monocoque structure in three sections. Oval forward section and circular centre and rear sections. All sections are quickly detachable. Aerodynamic brake in underside of centre section.

Tail Unit.—Cantilever monoplane type Tailplane mounted on fin. All-metal structure. Tailplane span 4.25 m. (13 ft. 11 in.).

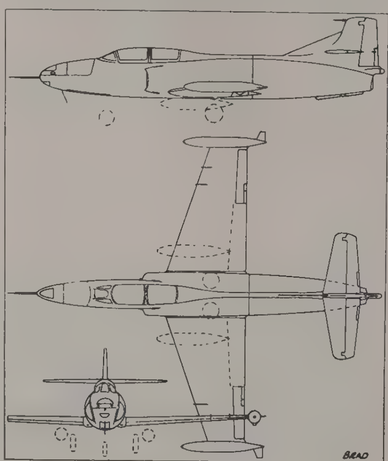
Landing Gear.—Retractable tricycle type. Main wheels raised inwardly, the nose-wheel forward. Hydraulic retraction. Hydraulic wheel brakes. Main wheel track 2.28 m. (7 ft. 6 in.). Wheelbase 4 m. (13 ft. 1 in.).

Power Plant.—One D.H. Goblin 35 turbojet engine rated at 1,590 kg. (3,500 lb.) s.t. mounted in fuselage centre-section. Fuel in six tanks, two in centre fuselage and two in each wing. Total internal fuel capacity 1,530 litres (337 Imp. gallons).

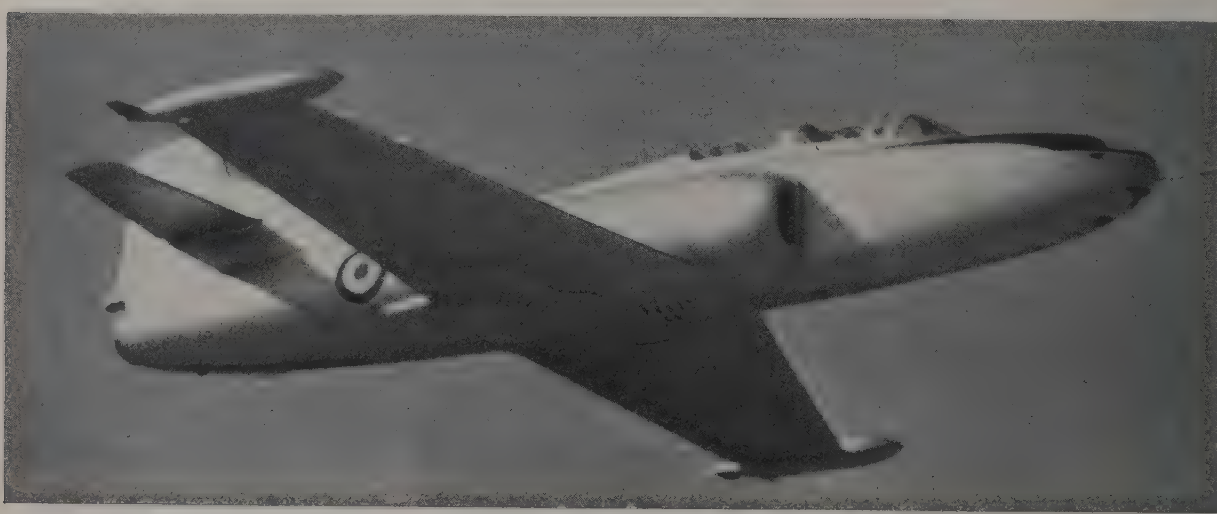
Accommodation.—Tandem enclosed cockpits seating two in tandem with dual controls, pupil in front and instructor behind. Martin-Baker seats and jettisonable cockpit covers. Normalair pressurisation. Full electrical equipment, radio, etc.

Armament.—Two Browning 0.50 in. machine-guns, one ciné camera gun, two bomb racks, one under each wing, and eight rocket racks, four under each wing, may be installed by fitting suitable adaptors.

Dimensions.—
Span 11.0 m. (36 ft. 1 in.).
Length 12.93 m. (42 ft. 5 in.).
Height 4.02 m. (13 ft. 3 in.).



The Fiat G.82.



The Fiat G.82 Fighter Trainer (Rolls-Royce Nene turbojet engine).

WEIGHT LOADED.—
5,800 kg. (12,800 lb.).
PERFORMANCE.—
Max. speed 830 km.h. (515 m.p.h.).
Cruising speed 550 km.h. (340 m.p.h.) at 9,000 m. (29,520 ft.).
Climb to 6,000 m. (19,680 ft.) 11 min.
Service ceiling 11,000 m. (36,080 ft.).
Normal range at 9,000 m. (29,520 ft.), including allowance for take-off, climb, descent and landing 1,000 km. (620 miles).

THE FIAT G.82.

The G.82 is a version of the G.80 fitted with the Rolls-Royce Nene turbojet engine. The general description of the G.80 applies to this model except for the following :—

TYPE.—Two-seat jet Fighter Trainer and Day and Night Flight Trainer.

POWER PLANT.—One Rolls-Royce Nene 2/21 turbojet engine rated at 2,270 kg. (5,000 lb.) s.t. mounted in centre portion of fuselage. Fuel in eight tanks, two in fuselage centre-section, four in wings and two wing-tip tanks. Total fuel capacity 1,755 litres (386 Imp. gallons). Two extra underwing tanks (300 litres = 66 Imp. gallons each) may be fitted.

DIMENSIONS.—
Span 11.808 m. (38 ft. 9½ in.).
Length 12.93 m. (42 ft. 5 in.).
Height 4.075 m. (13 ft. 4½ in.).

WEIGHTS AND LOADING.—
Weight empty 4,400 kg. (9,700 lb.).
Weight loaded 6,250 kg. (13,780 lb.).
Max. permissible weight 7,000 kg. (15,430 lb.).
Wing loading 248.6 kg./m.² (50.96 lb./sq. ft.).

PERFORMANCE.—
Max. speed at 3,000 m. (9,840 ft.) 910 km.h. (565 m.p.h.).
Min. speed with flaps 180 km.h. (112 m.p.h.).
Climb to 6,000 m. (19,680 ft.) 5 min. 30 sec.
Climb to 9,000 m. (29,520 ft.) 10 min. 30 sec.
Service ceiling 12,500 m. (41,000 ft.).
Max. range 1,600 km. (1,000 miles).
Max. endurance 165 min.
Take-off run with flaps 650 m. (710 yds.).

THE FIAT G.59.

The G.59 is now being built in the two following versions :—

G.59-4A. Single-seat Advanced Trainer. As a Fighter Trainer this aircraft can be fitted with two Breda SAFAT 12.7 mm. (0.50 in.). machine-guns in the wings. The wings are stressed to carry the following alternative armaments : 4 Hispano 20 mm. cannon or 4 12.7 mm. Browning machine-guns. Rack under each outer wing for bomb (14-160 kg. = 30-350 lb.) or 125 litre (27.5 Imp. gallon) drop tank. Total internal fuel capacity (4 tanks) 480 litres (105 Imp. gallons).

G.59-4B. Two-seat Dual-control Aerobatic Trainer. Tandem seats, the front seat being occupied by the pupil. Pupil's cockpit is identical to that of G.59-4A to simplify pupil's transfer from one to other. Provision for installation of one SAFAT 7.7 mm. (0.3 in.) machine-gun with 200 rounds in starboard wing with reduction in capacity of outer wing tank. Total normal internal fuel capacity 370 litres (81 Imp. gallons).

TYPE.—Single or two-seat Advanced Military Trainer.

WINGS.—Cantilever low-wing monoplane. All-metal structure with stressed-skin covering. Metal statically and aerodynamically-balanced ailerons with fabric covering. Trim-tab in port aileron. All-metal hydraulically-operated split-flaps. Wing area 21.11 m.² (227 sq. ft.).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Metal structure with stressed metal skin over tailplane and fin, and fabric covering to balanced elevators and rudder. Rudder trim-tab.

LANDING GEAR.—Retractable tail-wheel type. Oleo - pneumatic shock - absorber legs. Retractable tail wheel. Hydraulic operation. Elektron main wheels with hydraulic brakes.

POWER PLANT.—One Rolls-Royce Merlin 500/20 twelve-cylinder vee liquid-cooled engine rated at 1,130 h.p. at 2,850 r.p.m. at 5,030 m. (16,500 ft.) and with 1,400 h.p. available for take-off. Four-blade Fiat-Hamilton 5010 constant-speed airscrew 3.40 m. (11 ft. 2 in.) diameter. Fuel capacities : G.59-4A 480 litres (106 Imp. gallons) in four tanks, two in fuselage and one in each wing. G.59-4B 370 litres (81 Imp. gallons) in five tanks, all in wings. Provision for two 125 litre (27.5 Imp. gallon) drop tanks under wings in both versions.

ACCOMMODATION.—Single cockpit (G.59-4A) or tandem cockpits with dual controls (G.59-4B), all cockpits with sliding and jettisonable canopies. Oxygen equipment. Full radio and electrical equipment.

ARMAMENT (G.59-4A).—Two 12.7 mm. (0.50 in.) Breda-Safat machine-guns with 200 r.p.g. in wings. Bombs of from 14 kg. (30 lb.) to 160 kg. (350 lb.) may be carried on racks beneath wings. Provision for carrying 8 rockets under wings.

DIMENSIONS.—
Span 11.85 m. (38 ft. 10½ in.).
Length 9.47 m. (31 ft. 1 in.).
Height 3.68 m. (12 ft. 1 in.).

WEIGHTS AND LOADINGS (G.59-4A).—
Weight empty 2,800 kg. (6,180 lb.).
Pilot and parachute 85 kg. (185 lb.).
Fuel and oil 377 kg. (831 lb.).
Military equipment 198 kg. (436 lb.).
Normal loaded weight 3,460 kg. (7,630 lb.).
Max. permissible loaded weight 3,660 kg. (8,070 lb.).
Wing loading 164 kg./m.² (33.6 lb./sq. ft.).
Power loading 2.43 kg./h.p. (5.45 lb./h.p.).

WEIGHTS AND LOADINGS (G.59-4B).—
Weight empty 2,850 kg. (6,285 lb.).
Crew (2) and parachute 170 kg. (375 lb.).
Fuel and oil 297 kg. (660 lb.).
Military equipment 68 kg. (150 lb.).
Normal loaded weight 3,385 kg. (7,470 lb.).
Max. permissible loaded weight 3,585 kg. (7,905 lb.).
Wing loading 160.5 kg./m.² (32.9 lb./sq. ft.).
Power loading 2.38 kg./h.p. (5.35 lb./h.p.).

PERFORMANCE (G.59-4A).—
Max. speed 593 km.h. (368 m.p.h.) at 6,200 m. (20,400 ft.).
Cruising speed 464 km.h. (290 m.p.h.) at 5,450 m. (17,880 ft.).
Stalling speed with flaps 142 km.h. (88.5 m.p.h.).
Climb to 1,830 m. (6,000 ft.) 1 min. 40 sec.
Climb to 3,660 m. (12,000 ft.) 3 min. 47 sec.
Climb to 5,490 m. (18,000 ft.) 6 min. 14 sec.
Climb to 7,320 m. (24,000 ft.) 9 min. 5 sec.
Service ceiling 11,500 m. (37,700 ft.).
Cruising range 1,000 km. (620 miles) at 5,450 m. (17,880 ft.).

PERFORMANCE (G.59-4B).—
Max. speed 609 km.h. (380 m.p.h.) at 6,400 m. (21,000 ft.).
Cruising speed 460 km.h. (286 m.p.h.) at 5,550 m. (18,200 ft.).
Climb to 1,830 m. (6,000 ft.) 1 min. 48 sec.
Climb to 3,660 m. (12,000 ft.) 3 min. 47 sec.
Climb to 5,490 m. (18,000 ft.) 6 min.
Climb to 7,320 m. (24,000 ft.) 8 min. 32 sec.
Service ceiling 12,100 m. (39,700 ft.).
Cruising range 1,250 km. (780 miles) at 5,550 m. (18,200 ft.).


The Fiat G.59-4B Advanced Trainer (Rolls-Royce Merlin engine).

THE FIAT G.49.

The G.49 is the latest Fiat trainer which has been designed to fulfil all basic training requirements ; including day and night flying, instrument and radio-controlled navigation, aerobatic, etc. It is available in the two following versions :—

G.49-1. One 550 h.p. Alvis Leonides 502/4 engine driving a D.H. three-blade constant-speed airscrew.

G.49-2. One 600 h.p. Pratt & Whitney R-1340-S3H1 engine driving a Fiat-Hamilton two-blade constant-speed airscrew.

G.49-3. One 625 h.p. Instituto Aerotecnico I. Ae El Indio engine driving a three-blade constant-speed airscrew.

TYPE.—Two-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 6.54. All-metal structure. All-metal split flaps extend from aileron to aileron under fuselage. All-metal ailerons. Gross wing area 23.78 m.² (255 sq. ft.).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Tailplane span 3.734 m. (12 ft. 3 in.).

LANDING GEAR.—Retractable tail-wheel type. Hydraulic retraction. Oleo-pneumatic shock-absorbers. Hydraulic wheel brakes. Track 2.87 m. (9 ft. 5 in.).

POWER PLANT.—One 550 h.p. Alvis Leonides 502/4 (G.49-1) or 600 h.p. Pratt & Whitney R-1340-S3H1 (G.49-2) radial air-cooled engine, the former driving a D.H. three-blade and the latter a Fiat-Hamilton two-blade constant-speed airscrew, both 2.74 m. (9 ft.) diameter. Four thin-walled rubber fuel tanks in centre-section and outer wings. Total fuel capacity 340 litres (75 Imp. gallons). Two drop tanks, 125 litres (27.5 Imp. gallons) each, may be carried under wings.

ACCOMMODATION.—Tandem cockpits with dual controls, pupil in front and instructor behind. Sliding jettisonable canopies.


The Fiat G.49-1 Basic Trainer (Alvis Leonides engine).

Provision for fitting amber screens to front windshield or blind-flying hood. Oxygen equipment.

Armament.—One SAFAT 7.7 mm. (0.3 in.) machine-gun (200 rounds) in starboard wing, but structure stressed for installation of one 7.7 mm. (0.30 in.) or 12.7 mm. (0.50 in.) gun in each wing. Electrically-operated racks for practice bombs or four rockets under each wing.

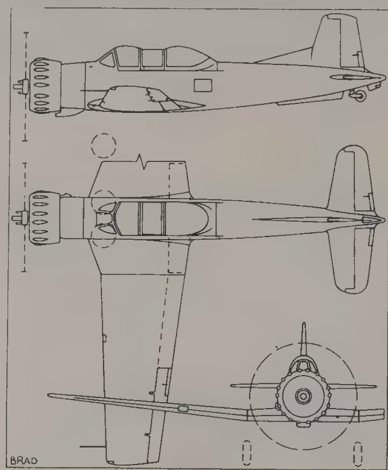
Dimensions.—
Span 12.47 m. (40 ft. 11 in.).
Length (G.49-1) 9.57 m. (31 ft. 4 in.).
Length (G.49-2) 9.40 m. (30 ft. 10 in.).
Height (G.49-1) 2.77 m. (9 ft. 1 in.).
Height (G.49-2) 2.73 m. (9 ft.).

Weights and Loadings.—
Weight empty 2,130 kg. (4,700 lb.).
Weight loaded (with guns) 2,680 kg. (5,910 lb.).
Weight loaded (with guns and bombs) 2,910 kg. (6,415 lb.).
Wing loaded 112.7 kg./m.² (23.24 lb./sq. ft.).
Power loading 4.65 kg./h.p. (10.25 lb./h.p.).

Performance (G.49-1).—
Max. speed at 1,000 m. (3,280 ft.) 360 km.h. (225 m.p.h.).
Min. speed with flaps 115 km.h. (72 m.p.h.).
Initial rate of climb 318 m./min. (1,043 ft./min.).
Climb to 2,000 m. (6,560 ft.) 5 min. 50 sec.
Climb to 4,000 m. (13,120 ft.) 12 min. 40 sec.
Climb to 6,000 m. (19,680 ft.) 24 min. 30 sec.
Service ceiling 7,300 m. (23,940 ft.).
Normal range 1,250 km. (776 miles).
Max. range 2,400 km. (1,490 miles).
Take-off run with flaps 260 m. (285 yds.).
Landing run with flaps 180 m. (195 yds.).

Performance (G.49-2).—
Max. speed at 1,500 m. (4,920 ft.) 370 km.h. (230 m.p.h.).
Min. speed with flaps 115 km.h. (73 m.p.h.).
Initial rate of climb 396 m./min. (1,300 ft./min.).
Climb to 2,000 m. (6,560 ft.) 4 min. 35 sec.
Climb to 4,000 m. (13,120 ft.) 10 min. 40 sec.
Climb to 6,000 m. (19,680 ft.) 21 min. 30 sec.
Service ceiling 7,300 m. (23,940 ft.).
Normal range 940 km. (585 miles).
Max. range 2,100 km. (1,305 miles).
Take-off run with flaps 230 m. (250 yds.).
Landing run with flaps 180 m. (195 yds.).

The Fiat G.49-2 Basic Trainer (Pratt & Whitney R-1340 engine).


The Fiat G.49-2.


The Fiat G.46-2 two-seat Trainer (245 h.p. D.H. Gipsy Queen 30 engine).

THE FIAT G.46.

The G.46 is available in the following versions :—

G.46-2. One D.H. Gipsy Queen Series 30 six-cylinder in-line inverted air-cooled engine rated at 245 h.p. at 2,500 r.p.m. and with same power for take-off. Fiat-Hamilton constant-speed airscrew.

G.46-4. One Alfa 115-1*ter* six-cylinder engine rated at 215 h.p. at 2,250 r.p.m. and with 225 h.p. for take-off. Fiat-Hamilton constant-speed airscrew. Available in two versions, the G.46-4A single-seat model and the G.46-4B two-seat model.

Type.—Two-seat Trainer.

Wings.—Cantilever low-wing monoplane. All-metal structure with flush-riveted metal covering. Fabric-covered metal ailerons and hydraulically-operated split trailing-edge flaps. Wing area 16 m.² (172.2 sq. ft.).

Fuselage.—All-metal monocoque structure.

Tail Unit.—All-metal cantilever monoplane type. Tailplane and fin covered with metal, elevators and rudder with fabric. Trim-tabs in elevators and rudder tab adjustable on ground.

Landing Gear.—Retractable tail-wheel type. Oleo-pneumatic shock-absorber struts. Steerable tail-wheel retracts into fuselage. Hydraulic operation.

Power Plant.—One 245 h.p. D.H. Gipsy Queen Series 30 (G-46-2) or 225 h.p. Alfa 115-1*ter* (G-46-4) six-cylinder in-line inverted air-cooled engine driving a two-blade constant-speed metal airscrew. Two fuel tanks of 160 litres (35.2 Imp. gallons) capacity in wings.

Accommodation.—Enclosed cabin seating two in tandem, with dual controls. Hood hinges for access and can be jettisoned. Forward arch reinforced and attached to fuselage as separate structure.

Dimensions.—Span 10.4 m. (34 ft. 1½ in.).
Length 8.48 m. (27 ft. 10 in.).
Height 2.4 m. (7 ft. 10 in.).

Weights and Loadings (G.46-2).—
Weight empty 1,110 kg. (2,450 lb.).
Crew (2) 170 kg. (375 lb.).
Fuel and oil 126 kg. (277 lb.).
Equipment 24 kg. (53 lb.).
Weight loaded 1,430 kg. (3,155 lb.).
Wing loading 89.5 kg./m². (18.30 lb./sq. ft.).
Power loading 5.83 kg./hp. (12.88 lb./h.p.).

Weights and Loadings (G.46-4B).—
Weight empty 1,110 kg. (2,450 lb.).
Crew (2) 170 kg. (375 lb.).
Fuel and oil 108 kg. (237 lb.).
Equipment (radio) or baggage 22 kg. (48 lb.).
Weight loaded 1,410 kg. (3,110 lb.).
Wing loading 88.5 kg./m.² (18.05 lb./sq. ft.).
Power loading 6.27 kg./h.p. (13.80 lb./h.p.).

Performance (G.46-2).—
Max. speed 327 km.h. (203 m.p.h.).
Cruising speed 286 km.h. (178 m.p.h.).
Min. speed (with flaps) 115 km.h. (72 m.p.h.).
Initial rate of climb 350 m./min. (1,060 ft./min.).
Climb to 2,000 m. (6,560 ft.) 6 min. 40 sec.
Climb to 4,000 m. (13,120 ft.) 16 min. 55 sec.
Service ceiling 6,050 m. (19,850 ft.).
Absolute ceiling 6,500 m. (21,320 ft.).
Cruising range 920 km. (570 miles).
Take-off run 217 m. (237 yds.).
Landing run (with flaps) 150 m. (165 yds.).

Performance (G.46-4B).—
Max. speed 312 km.h. (194 m.p.h.).
Cruising speed 250 km.h. (156 m.p.h.).
Min. speed (with flaps) 110 km.h. (68.5 m.p.h.).
Initial rate of climb 350 m./min. (1,150 ft./min.).
Climb to 2,000 m. (6,560 ft.) 7 min.
Climb to 4,000 m. (13,120 ft.) 19 min. 40 sec.
Service ceiling 5,400 m. (17,710 ft.).
Absolute ceiling 5,800 m. (19,025 ft.).
Cruising range 1,000 km. (620 miles) at 3,000 m. (9,840 ft.).
Take-off run 210 m. (230 yds.).
Landing run (with brakes) 170 m. (185 yds.).

The Fiat G.46-4B Two-seat Trainer (225 h.p. Alfa 115-1*ter* engine).

MACCHI

AERONAUTICA MACCHI S.A.

HEAD OFFICE: CORSO VITTORIO EMANUELE 31, MILAN.

OFFICES AND WORKS: VIA SANVITO SILVESTRO 80, VARESE.

President: Dott. Ing. Paolo Foresio.

Technical Director and Chief Engineer: Ing. Ermanno Bazzocchi.

The Macchi company was founded in 1912 in Varese and its first aeroplane was built in 1913.

Between the wars it established for itself a world-wide reputation as the designers and builders of a series of racing seaplanes. The Macchi 7 flying-boat won the 1921 Schneider Trophy contest, the Macchi 39 the 1926 contest and the Macchi 52*bis* was second in the 1929 contest.

In October, 1933, a Macchi-Castoldi 72 established a World's Speed Record at 709.2 km.h. (440.67 m.p.h.), and this still stands to the credit of Italy as a seaplane record.

Since the end of the war the Macchi company has developed the M.B. 308 two-seat light cabin monoplane, the M.B. 320, a twin-engined six-seat monoplane, and the M.B. 323 trainer. The M.B. 308 is in production and has been supplied to both the Italian Air Force and to the civil air authorities.

Macchi is building the Fokker S.11 under licence for the Italian Government under the designation M.416.

THE MACCHI M.B. 323.

TYPE.—Two-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. All-metal stressed skin structure. Hydraulically-operated trailing-edge flaps. Gross wing area 20.16 m.² (217 sq. ft.).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Statically and aerodynamically-balanced control surfaces.

LANDING GEAR.—Retractable tail-wheel type. Hydraulic retraction. Tricycle landing-gear being developed (M.B. 323T).

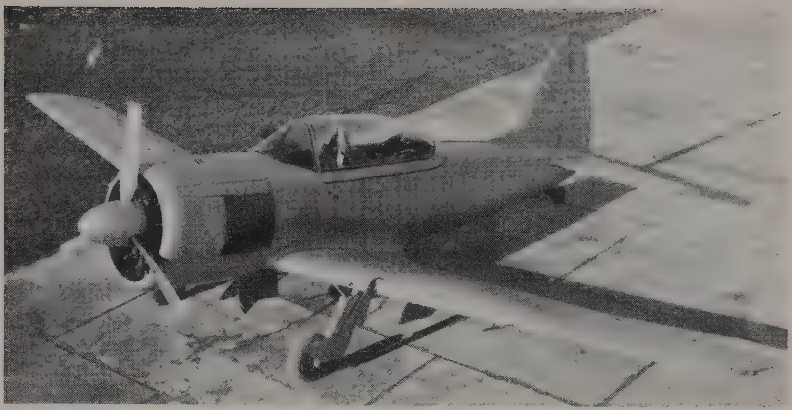
POWER PLANT.—One 610 h.p. Pratt & Whitney R-1340 nine-cylinder radial air-cooled engine.

ACCOMMODATION.—Crew of two in tandem under a single-piece moulded Perspex sliding canopy. Pupil in front, instructor behind, the latter's seat being higher. Dual controls and complete instrument duplication. Blind-flying screens for pupil. Equipment includes VHF and R/T radio, provision for ILS. One 7.7 mm. machine-gun in port wing, camera gun, racks for practice bombs, camera, etc. may be fitted.

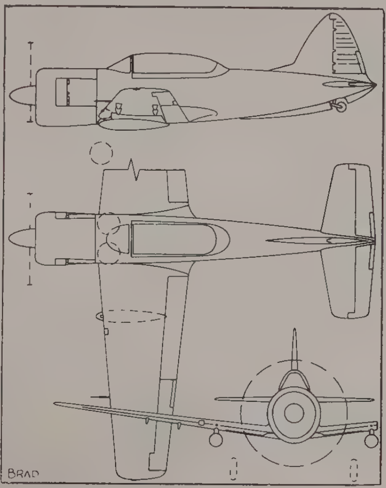
DIMENSIONS.—
- Span 12 m. (39 ft. 4½ in.).
- Length 9.14 m. (30 ft.).
- Height 4.04 m. (13 ft. 3 in.).

WEIGHTS AND LOADINGS.—
- Weight empty 2,000 kg. (4,400 lb.).
- Crew (2) 170 kg. (375 lb.).
- Fuel and oil 328 kg. (723 lb.).
- Military equipment 92 kg. (203 lb.).
- Weight loaded 2,590 kg. (5,710 lb.).
- Wing loading 128.5 kg./m.² (26.3 lb./sq. ft.). sq. ft.).
- Power loading 4.2 kg./h.p. (9.3 lb./h.p.).

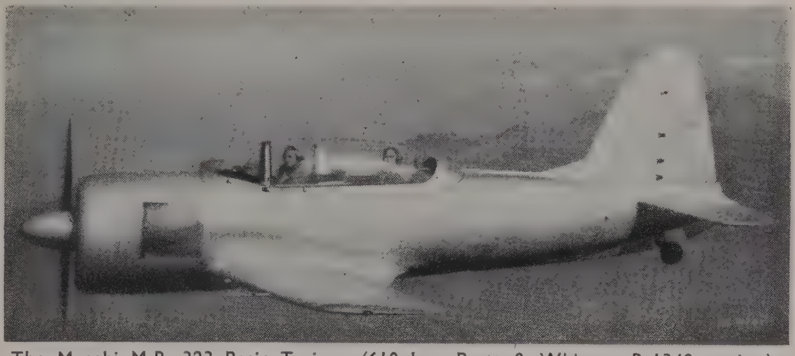
PERFORMANCE.—
- Max. speed 390 km.h. (242 m.p.h.) at 1,800 m. (5,900 ft.).
- Cruising speed (65% power) 320 km.h. (198.5 m.p.h.) at 3,000 m. (9,840 ft.).
- Min. speed (without flaps) 128 km.h. (79.4 m.p.h.).
- Min. speed (with flaps) 118 km.h. (73.2 m.p.h.).
- Climb to 1,000 m. (3,280 ft.) 2 min. 24 sec.
- Climb to 2,000 m. (6,560 ft.) 5 min.
- Service ceiling 6,500 m. (21,320 ft.).
- Absolute ceiling 7,000 m. (22,960 ft.).
- Range 1,300 km. (810 miles).
- Take-off run 250 m. (273 yds.).
- Landing run with brakes 280 m. (306 yds.).



The Macchi M.B. 323 Basic Trainer (610 h.p. Pratt & Whitney R-1340 engine).



The Macchi M.B.323.



The Macchi M.B. 323 Basic Trainer (610 h.p. Pratt & Whitney R-1340 engine).

THE MACCHI M.B.320.

TYPE.—Twin-engined six-seat monoplane.

WINGS.—Low-wing cantilever monoplane NACA 230 Series wing section. Aspect ratio 8. Wood single-spar structure with stressed plywood skin. Differentially-controlled slotted ailerons. Slotted flaps between ailerons and fuselage. Leading-edge anti-icing equipment. Gross wing area 21.13 m.² (227.1 sq. ft.).

FUSELAGE.—In three sections, a detachable metal nose, and centre and rear sections of wood with plywood stressed skin.

TAIL UNIT.—Cantilever monoplane type. All-wood plywood-covered structure. Trim tabs in starboard elevator and rudder. Anti-icing equipment on tailplane and fin.

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Full-swivelling nose wheel with centre lock and anti-shimmy damper. Hydraulic brakes.

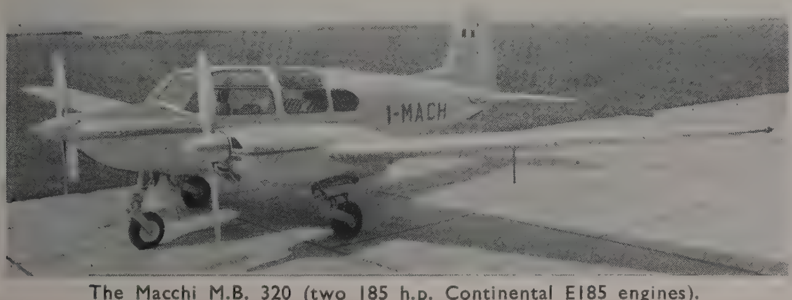
POWER PLANT.—Two 185 h.p. Continental E185 six-cylinder horizontally-opposed air-cooled engines. SIAI mechanically-controlled variable-pitch or Aeromatic automatic constant-speed airscrews. Four fuel tanks, two per engine, in wings aft of spar. Total fuel capacity 350 litres (77 Imp. gallons).

ACCOMMODATION.—Enclosed accommodation for two pilots side-by-side with dual controls and four passengers seated in pairs. Baggage compartment aft of rear seats, which can be removed to increase stowage space if needed. Cabin is sound-proofed and air-conditioned. Full electrical equipment.

DIMENSIONS.—
- Span 13 m. (42 ft. 7½ in.).
- Length 8.66 m. (28 ft. 5 in.).
- Height 3.19 m. (10 ft. 6 in.).

WEIGHTS AND LOADINGS.—
- Weight empty 1,660 kg. (3,652 lb.).
- Pilot and 5 passengers 450 kg. (990 lb.).
- Baggage 54 kg. (119 lb.).
- Fuel and oil 288 kg. (634 lb.).
- Weight loaded 2,500 kg. (5,500 lb.).
- Wing loading 113.3 kg./m.² (24.2 lb./sq. ft.).
- Power loading 6.65 kg./h.p. (14.3 lb./h.p.).

PERFORMANCE.—
- Max. speed 300 km.h. (136.5 m.p.h.).
- Cruising speed (70% power) 252 km.h. (156.5 m.p.h.) at 2,000 m. (6,560 ft.).
- Min. speed 115 km.h. (73 m.p.h.).
- Climb to 1,000 m. (3,280 ft.) 4 min.
- Climb to 2,000 m. (6,560 ft.) 9 min.
- Climb to 3,000 m. (9,840 ft.) 15 min. 30 sec.
- Climb to 4,000 m. (13,120 ft.) 25 min.



The Macchi M.B. 320 (two 185 h.p. Continental E185 engines).

Service ceiling 4,500 m. (14,750 ft.).
Single-engine service ceiling 1,150 m. (3,780 ft.).
Cruising range (10 km.h. = 6.2 m.p.h. head wind) 1,070 km. (666 miles) at 240 km.h. (149 m.p.h.) at 2,000 m. (6,560 ft.).
Take-off run 280 m. (305 yds.).
Landing run 250 m. (273 yds.).

THE MACCHI M.B. 308.

TYPE.—Two-seat Light Cabin monoplane.

WINGS.—High-wing cantilever monoplane. NACA 230 Series wing section. One-piece monospar wing structure. Main spar of spruce and plywood, the wing forward of the spar being covered with plywood to form a D-section torsionally-stiff structure. Aft of the spar wings are fabric covered. Differentially-operated slotted ailerons. Slotted flaps between ailerons and fuselage. Three flap positions, 15° for take-off, 60° for normal landing and 75° for braked landing. Gross wing area 13.72 m.² (147.6 sq. ft.).

FUSELAGE.—Rectangular wooden structure with spruce framework and plywood covering.

TAIL UNIT.—Cantilever monoplane type. All-wood structure with plywood-covered fin, tailplane and elevators, plywood and fabric-covered rudder. Controllable trim-tab in elevator.

LANDING GEAR.—Fixed tricycle type. Steerable nose-wheel on long-stroke oleo-spring shock-absorber strut attached to sloping engine compartment bulkhead. Main wheels on hinged cantilever struts with rubber-in-compression springing within fuselage. Hydraulic wheel brakes on main wheels.

POWER PLANT.—One 85 h.p. Continental C85 or 90 h.p. Continental C90 four-cylinder horizontally-opposed air-cooled engine. Fuel tank above baggage compartment in fuselage. Capacity 80 litres (17.6 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Baggage compartment behind seats and accessible in flight. Entrance door on each side.

DIMENSIONS.—
Span 10 m. (32 ft. 9½ in.).
Length 6.527 m. (21 ft. 5 in.).
Height 2.175 m. (7 ft. 2 in.).

WEIGHTS AND LOADINGS (Continental C85 engine).—
Weight empty 410 kg. (902 lb.).
Pilot and passenger 150 kg. (330 lb.).
Fuel and oil 67 kg. (148 lb.).
Baggage 23 kg. (51 lb.).
Weight loaded 650 kg. (1,450 lb.).
Wing loading 47.3 kg./m.² (9.7 lb./sq. ft.).
Power loading 7.56 kg./h.p. (16.8 lb./h.p.).

WEIGHTS AND LOADINGS (Continental C90 engine).—
Weight empty 410 kg. (902 lb.).
Weight loaded 650 kg. (1,430 lb.).
Wing loading 47.3 kg./m.² (9.69 lb./sq. ft.).
Power loading 7.16 kg./h.p. (15.75 lb./h.p.).

PERFORMANCE (Continental C85 engine).—
Max. speed 197 km.h. (122 m.p.h.).
Cruising speed (70% power) 164 km.h. (102 m.p.h.).
Landing speed 68 km.h. (42.2 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 6 min.
Service ceiling 4,500 m. (14,750 ft.).
Cruising range 760 km. (470 miles).

PERFORMANCE (Continental C90 engine).—
Max. speed 203 km.h. (126 m.p.h.).
Cruising speed (70% power) 170 km.h (105.5 m.p.h.).
Landing speed 68 km.h. (42.2 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 5 min.
Service ceiling 5,000 m. (16,400 ft.).
Cruising range 720 km. (445 miles).
Take-off run 100 m. (109 yds.).
Landing run 60 m. (66 yds.).

The Macchi M.B. 308G Three-seater (90 h.p. Continental C90 engine).

THE MACCHI M.B.308G.

The M.B. 308 with the 90 h.p. Continental C90 engine is also in production as a three-seater, the third seat being at the back of the cabin. Two small side windows are added for the extra seat.

WEIGHTS.—
Weight empty 430 kg. (946 lb.).
Weight loaded 720 kg. (1,584 lb.).

PERFORMANCE.—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 167 km.h. (103.7 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 6 min.
Ceiling 3,800 m. (12,460 ft.).
Max. range 540 km. (335 miles).
Take-off run 160 m. (175 yds.).

THE MACCHI M.B. 308 SEAPLANE.

The M.B. 308 in two-seat form is also available as a twin-float seaplane. Fitted with the 90 h.p. Continental C90 engine this aircraft has the following characteristics :—

DIMENSIONS.—
As for M.B. 308 landplane, except length 6.617 m. (21 ft. 3½ in.).

WEIGHTS.—
Weight empty 470 kg. (1,035 lb.).
Weight loaded 690 kg. (1,520 lb.).

PERFORMANCE.—
Max. speed 194 km.h. (120 m.p.h.).
Cruising speed 165 km.h. (105.5 m.p.h.).
Stalling speed 70 km.h. (43.4 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 6 min.
Ceiling 4,200 m. (13,600 ft.).
Max. range 700 km. (435 miles.).
Take-off run (from water) 240 m. (262 yds.).

METEOR

METEOR s.p.a. COSTRUZIONI AERONAUTICHE.

HEAD OFFICE : 2 VIA MILANO, TRIESTE.
ROME OFFICE : 4 LARGO BERCHET.
WORKS : RONCHI DEI LEGIONARI, MONFALCONE.
Chairman and Managing Director : Avv. Furio Lauri.

Meteor s.p.a. was formed in 1947 to undertake the manufacture of aircraft, the operation of feeder-line air services and the management and operation of airports.

In the field of aircraft construction, Meteor has continued the activities of the aeronautical department of the Cantieri Riuniti dell'Adriatico, Monfalcone, which, before the last war built CANT-Zappata aircraft.

Originally Meteor undertook the construction of gliders and sailplanes of various types, including the Meteor MS.18, MS.21, MS.30 and, under licence, the Canguru type sailplanes. The company continues to supply all accessories and equipment for glider flying, notably the Meteor Dolomiti glider-winch with automatic hydraulic gears and double cable drum.

In 1953 Meteor s.p.a. took over the aeronautical designs and equipment of Francis Lombardi & C. (formerly Azionari Vercellese Industrie Aeronautiche—AVIA) of Vercelli, and has subsequently developed from the pre-war AVIA (Lombardi) FL.3, of which some 400 were built before 1942, its current productions. These are the FL.53 two-seat aerobatic monoplane for touring and training, and the FL.54 and FL.55 general-purpose three-seaters with differing power-plants which may be used for many purposes, including glider-towing, agricultural dusting and spraying, etc. Details of these aircraft follow.

The Meteor FL.53 (60 h.p. C.N.A. D.4 engine).

THE METEOR FL. 53.

TYPE.—Two-seat Trainer and Tourer.

WINGS.—Low-wing cantilever monoplane. All-wood structure. Differential ailerons. Flaps not normally fitted, but can be on request. Wing area 13.9 m.² (150 sq. ft.).

FUSELAGE.—Of mixed steel-tube and wood construction with fabric covering.

TAIL UNIT.—Braced monoplane type. Steel-tube framework covered with fabric.

LANDING GEAR.—Fixed tail-wheel type. Rubber-in-compression springing. Hydraulic brakes on main wheels. Steerable tail-wheel.

POWER PLANT.—One 60 h.p. C.N.A.D.4 or 65 h.p. Continental A65 four-cylinder air-cooled engine. Fuel tank (17 U.S. gallons = 64 litres) in fuselage. Provision for external auxiliary tank of similar capacity below fuselage. Filler cap of latter tank accessible through hole in underside of fuselage to permit contents to be transferred to main tank by hand-pump.

ACCOMMODATION.—Two seats side-by-side with dual controls beneath sliding Plexiglas canopy. Roof and rear section of canopy tinted for glare protection. Seat backs are adjustable so that they can be used with or without parachutes. Canopy has spring release for emergency exit.

DIMENSIONS.—
Span 9.85 m. (32 ft. 3½ in.).
Length 6.37 m. (20 ft. 10½ in.).
Height 1.80 m. (5 ft. 10½ in.).

WEIGHTS.—
Weight empty 350 kg. (770 lb.).
Disposable load (normal) 220 kg. (484 lb.).
Disposable load (aerobatic) 175 kg. (385 lb.).
Weight loaded (normal) 570 kg. (1,254 lb.).
Weight loaded (aerobatic) 525 kg. (1,155 lb.).

PERFORMANCE (normal A.U.W.—60 h.p. C.N.A. engine).
Max. speed 163 km.h. (102 m.p.h.).

Cruising speed 139 km.h. (87 m.p.h.).
Initial rate of climb 116 m./min. (380 ft./min.).
Service ceiling 3,965 m. (13,000 ft.).
Absolute ceiling 4,730 m. (15,500 ft.).
Stalling speed 59 km.h. (37 m.p.h.).
Take-off run (no wind) 150 m. (490 ft.).
Landing run (without brakes) 100 m. (328 ft.).
Endurance 2½ hours.

THE METEOR FL. 54.

The FL.54 is a three-seat higher-powered version of the FL.53. It can be fitted with either the 85 h.p. or 90 h.p. Continental engine. The third seat is placed centrally in the rear of the cabin.

The FL.54 is a general purpose aircraft which can be used for touring, training, glider-towing, etc.

DIMENSIONS.—
Same as for FL. 53.

WEIGHTS (90 h.p. Continental C90 and metal propeller).—
Weight empty 350 kg. (770 lb.).
Normal disposable load 272 kg. (600 lb.).
Normal loaded weight 622 kg. (1,370 lb.).

PERFORMANCE (90 h.p. Continental C90 engine and metal propeller).—
Max. speed 163 km.h. (102 m.p.h.).
Cruising speed 138 km.h. (86 m.p.h.).
Initial rate of climb 183 m./min. (600 ft./min.).
Service ceiling 4,575 m. (15,000 ft.).
Absolute ceiling 4,970 m. (16,300 ft.).
Stalling speed 75 km.h. (47 m.p.h.).
Take-off run (no wind) 150 m. (490 ft.).
Landing run (without brakes) 100 m. (328 ft.).

THE METEOR FL. 55.

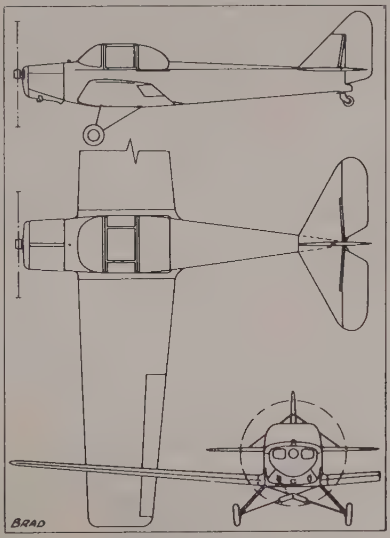
The FL.55 is similar to the FL.54 but has a reinforced airframe and is fitted with a 150 h.p. Lycoming engine.

In addition to touring and training, the FL.55 can be adapted for agricultural work (spraying and dusting), high-altitude glider towing, etc. It can also be fitted with floats or skis.

The standard 3-seat version is fitted with dual controls, flaps, electric starter, VHF radio and standard instrument panel.

The spraying and dusting equipment, which can be installed or removed in 15 minutes, consists of a spray or dust tank with a capacity for 350 kg. (770 lb.), wind-driven centrifugal pump, gauges, controls and spray booms and 48 nozzles or a Venturi-type dust distributor. The tank is fitted in place of the third seat.

The Meteor FL.55 Agricultural Monoplane (150 h.p. Lycoming engine).



The Meteor FL. 53.

During spraying or dusting operations the Plexiglas canopy is removed completely to facilitate refilling.

At the time of writing the FL.55 was undergoing homologation trials as a four-seater at an all-up weight of 780 kg. (1,720 lb.).

DIMENSIONS.—
Same as for FL. 53.

WEIGHTS (Standard 3-seat version).—
Weight empty 423 kg. (932 lb.).
Pilot and 2 passengers 225 kg. (495 lb.).
Fuel and oil 50 kg. (110 lb.).
Baggage 7 kg. (16 lb.).
Weight loaded 705 kg. (1,553 lb.).

WEIGHTS (Agricultural version).—
Weight empty 493 kg. (1,085 lb.).
Pilot 73 kg. (162 lb.).
Spraying liquid or dust 350 kg. (770 lb.).
Fuel and oil 50 kg. (110 lb.).
Weight loaded 966 kg. (2,127 lb.).

PERFORMANCE (Standard 3-seat version).—
Max. speed 200 km.h. (125 m.p.h.).
Cruising speed 176 km.h. (110 m.p.h.).
Initial rate of climb 244 m./min. (800 ft./min.).
Absolute ceiling 6,000 m. (19,680 ft.).
Take-off run (no wind) 100 m. (338 ft.).
Landing run (with flaps and brakes) 80 m. (262 ft.).

PERFORMANCE (Agricultural version).—
Operational speed 104-120 km.h. (65-75 m.p.h.).
Stalling speed at gross weight 75 km.h. (47 m.p.h.).
Take-off run at gross weight (no wind) 205 m. (670 ft.).
Endurance 2 hours.

NARDI

NARDI S.A. PER COSTRUZIONI AERONAUTICHE.

HEAD OFFICE AND WORKS: AEROPORTO FORLANINI, MILAN.

President: Dr. Ing. Luigi Nardi.

Vice-President: Dr. Elto Nardi.

This concern was established by the four Nardi brothers in Milan in 1933. Their first product, the F.N. 305, first flew in 1935.

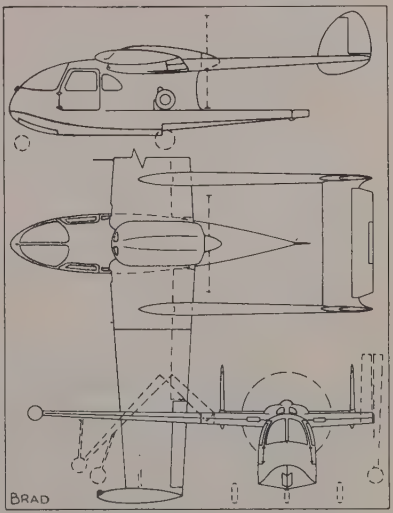
The Nardi factory at Loreto was almost completely destroyed during the war but the Milan factory has been rebuilt and the company has now completed its first post-war aircraft, the FN-333 all-metal amphibian, the prototype of which flew for the first time on December 4, 1952.

The first prototype was a three-seater and was powered by a 145 h.p. Continental engine. From this has been developed the four-seat production model of slightly larger dimensions and powered by a 240 h.p. Continental engine. A prototype of this version first flew on December 8, 1954, and the first production aircraft was expected to fly before the end of 1955.

In addition to aircraft manufacture, the company has specialised in the production of wheels, brakes, retractable landing gears, hydraulic and electric aircraft controls, fuel pumps, armament installations and aircraft accessories generally. The Nardi company is the agent and licensee of the American Bendix and British Dunlop companies for landing-gears, wheels, brakes and hydraulic mechanisms for brakes, landing-gear retraction, etc.

The company is also included in the list of firms approved by the Aeronautical Inspection Directorate of the British Ministry of Supply.

The Nardi FN-333 Amphibian (145 h.p. Continental engine).



The Nardi FN-333 Amphibian.

THE NARDI FN-333.

TYPE.—Three-seat boat Amphibian.

WINGS.—Shoulder-wing cantilever monoplane. NACA 23000 Series wing section. Aspect ratio 6.5. Two-spar all-metal stressed-skin construction. Centre-section, attached to hull, carries tail-booms and engine

mounting. Statically and aerodynamically balanced ailerons. Split flaps inboard of ailerons. Gross wing area 14.8 m.^{2} (159.2 sq. ft.).

HULL.—Single-step all-metal stressed-skin structure. Hull below cabin floor has series of watertight compartments. Deck of rear portion provided with manholes and drain openings. Rudder hinged to sternpost.

TAIL BOOMS.—Each is a tapered tube made from a single duralumin sheet. Bolted to wing centre-section through flanged duralumin collars.

TAIL UNIT.—Rectangular tailplane between ends of booms. Upper and lower fins riveted to booms. Statically and aerodynamically balanced elevator has central controllable trim-tab. Aerodynamically-balanced rudders. Entire tail-unit is of metal stressed-skin construction. Tailplane span (centre-line of booms) 2.50 m. (8 ft. 2 in.).

LANDING GEAR. — Retractable nose-wheel type. Two main units are independent but are retracted by a single hydraulic jack. When retracted each unit is entirely buried in side of hull. Nardi oleo-pneumatic shock-struts. Wheels are of peralumin anti-corrosive alloy and have Nardi hydraulic disc brakes. Main wheel track 1.88 m. (6 ft. 2 in.). Wheelbase 2.80 m. (9 ft. 2 in.).

WING TIP FLOATS.—Retractable floats are of peralumin non-corrosive alloy and are carried on single struts. Hydraulic retraction. When raised are located at wing-tips.

POWER PLANT.—One 240 h.p. Continental O-470-H six-cylinder horizontally-opposed fan-cooled engine buried in centre-section. Hartzell constant-speed pusher propeller with armoured wood blades. Electric starter. Two fuel tanks in wings. Total fuel capacity 260 litres (57 Imp. gallons).

ACCOMMODATION.—Cabin seats four, two side-by-side in front with dual controls and two on a bench-type seat behind. Sound-proofed, air-conditioned and heated cabin. Large door on each side and backs of front seats hinge forward to give access to rear seat. Radio. Electric position indicators for landing-gear, flaps and wing-tip floats.

DIMENSIONS.—
Span 10.16 m. (33 ft. 4 in.).
Length overall 7.30 m. (23 ft. 11 in.).
Height overall 2.50 m. (8 ft. 2½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 840 kg. (1,850 lb.).
Disposable load 460 kg. (1,010 lb.).
Weight loaded 1,300 kg. (2,860 lb.).
Wing loading 88 kg./m.^{2} (26,8 lb./h.p.).
Power loading 5.4 kg./h.p. (11.8 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 290 km.h. (180 m.p.h.).
Cruising speed 260 km.h. (166 m.p.h.).
Min. speed with flaps 101 km.h. (63 m.p.h.).
Rate of climb at S/L. 390 m./min. (1,280 ft./min.).
Service ceiling 6,000 m. (19,680 ft.).
Normal range 800 km. (500 miles).
Max. range 1,250 km. (870 miles).
Take-off run on ground 180 m. (19 yds.).

PASOTTI

LEGNAMI PASOTTI S.p.A.

HEAD OFFICE AND WORKS: VIA MASSIMO D'AZEGLIO 6, BRESCIA.

Director: Dott. Ing. Piero Pasotti.

This company has built the F.6 four-seat cabin monoplane which is described below. The F.6 is designed to serve as a four-seat touring aeroplane which will also be suitable for use as an executive transport or as an ambulance.

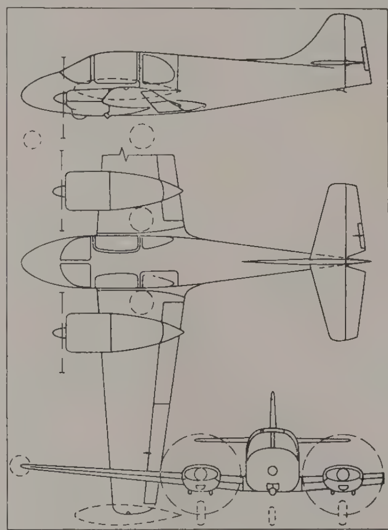
THE PASOTTI F.6 AIRONE.

TYPE.—Four-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 7.4. Mean chord 1.43 m. (4 ft. 8 in.). Single-piece single-spar wing of all wood construction with stressed plywood skin. Differential ailerons. Trailing-edge flaps. Area of ailerons 1.51 m.^{2} (16.25 sq. ft.). Flap area 2.10 m.^{2} (22.6 sq. ft.). Gross wing area 15.3 m.^{2} (165 sq. ft.).

FUSELAGE.—All-wood stressed-skin monocoque structure in two sections bolted together aft of trailing-edge of wing.

TAIL UNIT.—Cantilever monoplane type. Of similar structure to wings. Fixed surfaces covered with plywood, movable surfaces with fabric. Areas: fin 0.73 m.^{2} (7.85 sq. ft.), rudder 0.69 m.^{2} (7.42 sq. ft.), tailplane 1.02 m.^{2} (10.9 sq. ft.), elevators 1.68 m.^{2} (18.07 sq. ft.). Span of tail 3.31 m. (10 ft. 10 in.).



The Pasotti F.6 Airone.

LANDING GEAR.—Retractable nose-wheel type. Main landing gear struts of knee-action type with oleo-pneumatic springing. Long-stroke nose-wheel shock-absorber strut with hydraulic anti-shimmy device. Hydraulic wheel-brakes.

POWER PLANT.—Two 140 h.p. Lycoming O-290 four-cylinder horizontally-opposed air-cooled engines. Other engines of from 90 h.p. to 140 h.p. can be installed. Fixed- or controllable-pitch airscrews may be fitted. In production aircraft all fuel in two wing-tip tanks, each of 150 litres (33 Imp. gallons) capacity. In prototype tanks are in fuselage forward of cabin.

ACCOMMODATION.—Enclosed cabin seating four in two pairs, front pair with dual controls. Wide metal door on each side. Baggage compartment behind cabin with outside access. Cabin is sound-proofed and air-conditioned. Radio and night-flying equipment.

DIMENSIONS.—
Span 10.60 m. (34 ft. 9 in.).
Length 7.25 m. (23 ft. 9 in.).

WEIGHTS AND LOADINGS.—
Weight empty 900 kg. (1,980 lb.).
Weight loaded 1,460 kg. (3,210 lb.).
Wing loading 95.4 kg./m.^{2} (19.55 lb./sq. ft.).
Power loading 5.2 kg./h.p. (11.44 lb./h.p.).

PERFORMANCE (140 h.p. Lycoming).—
Max. speed 310 km.h. (192.5 m.p.h.).
Normal cruising 270 km.h. (168 m.p.h.).
Stalling speed 95 km.h. (59 m.p.h.).
Ceiling 6,500 m. (21,320 ft.).
Max. range 1,150 km. (715 miles).
Take-off run 250 m. (273 yds.).
Landing run 150 m. (164 yds.).

PIAGGIO

PIAGGIO & C., SOCIETA' PER AZIONI.

HEAD OFFICE: VIA ANTONIO CECCHI 6, GENOA (434).

BRANCH OFFICES: ROME AND MILAN.

WORKS: FINALE-LIGURE, PONTEDERA, PISA AND GENOA-SESTRI.

Managing Directors: Ing. Armando Piaggio and Dr. Enrico Piaggio.

Technical Directors: Ing. Filippo Schiaffino (Railway Division), Ing. Corradino D'Ascanio (Automotive and Helicopter Division) and Ing. Giovanni P. Casiraghi (Aircraft Division).

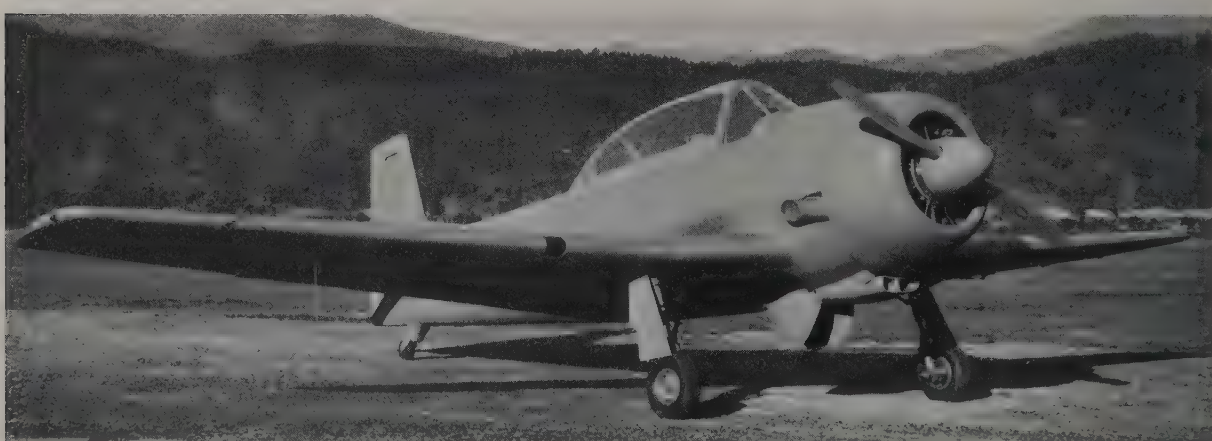
This famous engineering firm began the construction of aeroplanes in its Genoa-Sestri plant in 1916, and later in the Finale-Ligure works. In 1938 Plant No. 2 at Pontedera was built for the construction of large multi-engined all-metal aircraft. At the Finale-Ligure plant the Piaggio company operates the first (1930) privately-owned wind tunnel and the only privately-owned water tank for seaplane model testing in Italy.

Since the war Piaggio has developed the P.136 twin-engined amphibian flying-boat, fourteen of which have been supplied to the Italian Air Force for training and coastal reconnaissance; and the P.148 two-seat primary trainer, which has been adopted as a standard type by the Italian Air Force and is now in series production.

A licence to manufacture the P.136 amphibian in the United States has been acquired by the Royal Aircraft Corporation of Milwaukee, Wis.

At present the latest versions, the P.136-L and P.136-L-1, differing only in types of Lycoming engines fitted, will be assembled and sold throughout North America under the name of "Royal Gull."

The P.150 two-seat basic trainer, which was under development in 1951-52, made



The Piaggio P.150 Two-seat Basic Trainer (550 h.p. Pratt & Whitney R-1340 engine).

its first flight in October, 1952, and the P.149 four-seat cabin monoplane derived from the P.148, of which it uses many structural parts, flew in July, 1953.

Still under development in 1955, were the P.145 twin-engined civil transport powered by Armstrong Siddeley Double-Mamba turboprop engines, and the P.138 a large twin-engined amphibian for air/sea-rescue work, powered by Napier Nomad engines.

Piaggio is also interested in the development of radio-controlled target aircraft and of a transonic interceptor fighter.

At its Pontedera works Piaggio has resumed limited production of airscrews and pursues the experimental development of helicopters.

THE PIAGGIO P.150.

TYPE.—Two-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Wing section derived from NACA 230 and NACA 4412. Aspect ratio 6.6. Dihedral 5°. Incidence 2°. Chord at root 2.75 m. (7 ft. 0 in.), at tip 1.25 m. (4 ft. 1 in.). Single-spar box structure of riveted aluminium-alloy with smooth skin covering. Slotted flaps and ailerons of similar construction to wings. Total area of flaps 3.32 m.^{2} (35.74 sq. ft.). Total aileron area 2.03 m.^{2} (21.85 sq. ft.). Gross wing area 25.20 m.^{2} (271.25 sq. ft.).

FUSELAGE.—Oval section monocoque of riveted aluminium-alloy.

TAIL UNIT.—Cantilever monoplane type. Of similar construction to wings. Areas: fin 1.15 m.^{2} (12.38 sq. ft.), rudder 1.20 m.^{2} (12.92 sq. ft.), tailplane 2.50 m.^{2} (26.91 sq. ft.), elevators (total) 1.85 m.^{2} (19.91 sq. ft.). Tailplane span 4.35 m. (14 ft. 3 in.).

LANDING GEAR.—Retractable main wheels and non-retractable steerable tail-wheel. Hydraulic retraction. Oleo-pneumatic shock-absorbers. Hydraulic wheel brakes, with parking feature. Track 3.21 m. (10 ft. 6$\frac{1}{4}$ in.). Wheelbase 6.45 m. (21 ft. 2 in.).

POWER PLANT.—One Pratt & Whitney Wasp R-1340-S3H1 nine-cylinder radial air-cooled engine, normally rated at 550 h.p. at 1,525 m. (5,000 ft.) and with 600 h.p. available for take-off. Hamilton Standard two-blade constant-speed airscrew. Four fuel tanks in centre-section, two on each side of fuselage. Total fuel capacity 620 litres (136.4 Imp. gallons = 164 U.S. gallons). Oil capacity 55 litres (12.1 Imp. gallons = 14.5 U.S. gallons).

ACCOMMODATION.—Crew of two in tandem seats with complete dual controls under sliding bubble canopy. Full blind-flying and navigational training equipment. Radio. Provision for camera.

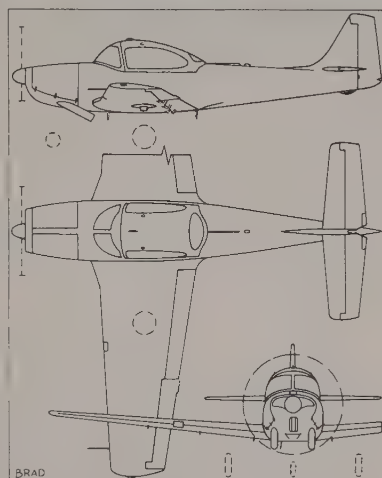
ARMAMENT.—Provision for installing one 7 mm. machine-gun in port wing, gun-sight in front cockpit, plus racks under wings for bombs and rockets.

DIMENSIONS.—
- Span 12.90 m. (42 ft. 4 in.).
- Length 9.25 m. (30 ft. 4 in.).
- Height 2.80 m. (9 ft. 2 in.).

WEIGHTS AND LOADINGS.—
- Weight empty 1,940 kg. (4,277 lb.).
- Disposable load 600 kg. (1,323 lb.).
- Weight loaded 2,540 kg. (5,600 lb.).
- Wing loading 101 kg./m.^{2} (20.7 lb./sq. ft.).
- Power loading 4.15 kg./h.p. (9.34 lb./h.p.).

PERFORMANCE.—
- Max. speed 350 km.h. (218 m.p.h.) at 1,830 m. (6,000 ft.).
- Cruising speed 315 km.h. (196 m.p.h.) at 2,000 m. (6.560 ft.).
- Stalling speed at S/L. 103 km.h. (64 m.p.h.).
- Climb to 2,000 m. (6,560 ft.) 4 min. 30 sec.
- Climb to 4,000 m. (13,120 ft.) 11 min. 8 sec.
- Climb to 6,000 m. (19,680 ft.) 24 min.

The Piaggio P.149 four-seat cabin monoplane (260 h.p. Lycoming engine).



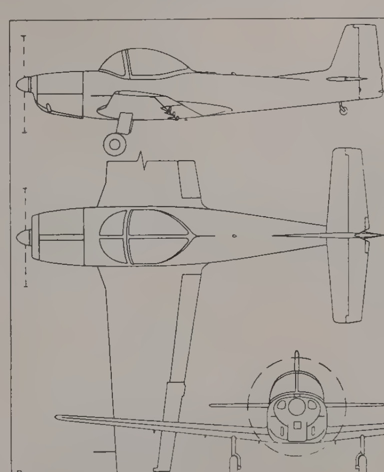
The Piaggio P.149 Tourer.

- Service ceiling 7,300 m. (23,950 ft.).
- Range (including allowance for starting, warm-up, take-off and climb, plus half-hour reserve) 1,400 km. (870 miles).
- Duration (full tanks) 4.5 hours.
- Take-off run (no wind) 180 m. (590 ft.).
- Landing run (no wind) 200 m. (656 ft.).

THE PIAGGIO P.149.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Same as for P.148.



The Piaggio P.148 Trainer.

FUSELAGE.—Oval section all-metal monocoque of similar construction to P.148.

TAIL UNIT.—Same as for P.148.

LANDING GEAR.—Retractable nose-wheel type. Electric retraction, with emergency manual operation. Oleo-pneumatic shock-absorbers. Hydraulic wheel brakes. Track 3.15 m. (10 ft. 4 in.). Wheelbase 2.03 m. (6 ft. 8 in.).

POWER PLANT.—One 260 h.p. Lycoming GO-435-C2 six-cylinder horizontally-opposed geared air-cooled engine. Piaggio P.1031 three-blade constant-speed airscrew. Three fuel tanks in wings. Total fuel capacity 240 litres (52.8 Imp. gallons = 63.4 U.S. gallons). Oil capacity 11.3 litres (2.5 Imp. gallons = 3.0 U.S. gallons).

ACCOMMODATION.—Enclosed accommodation for four in two pairs, the front pair with dual controls. Canopy slides backward for access. Large baggage compartment behind rear seats. Complete blind-flying and navigation instrumentation, including radio and D/F.

DIMENSIONS.—
- Span 11.12 m. (36 ft. 6 in.).
- Length 8.52 m. (27 ft. 11 in.).
- Height 2.85 m. (9 ft. 4 in.).

WEIGHTS AND LOADINGS.—
- Weight empty 1,110 kg. (2,447 lb.).
- Disposable load 540 kg. (1,190 lb.).
- Weight loaded 1,650 kg. (3,637 lb.).
- Wing loading 87.5 kg./m.^{2} (17.9 lb./sq. ft.).
- Power loading 6.35 kg./h.p. (14.0 lb./h.p.).

PERFORMANCE.—
- Max. speed at S/L. 282 km.h. (175 m.p.h.).
- Max. speed at 2,000 m. (6,560 ft.) 270 km.h. (169 m.p.h.).
- Cruising speed at 2,000 m. (6,560 ft.) at 70% METO power 250 km.h. (155 m.p.h.).
- Stalling speed at S/L. (with flaps) 92 km.h. (57 m.p.h.).
- Initial rate of climb 300 m./min. (980 ft./min.).
- Service ceiling 5,200 m. (17,000 ft.).
- Range (including allowance for starting, warm-up, take-off and climb, plus $\frac{1}{2}$ hour reserve) at 2,000 m. (6,560 ft.) and with full tanks 1,060 km. (660 miles).
- Take-off run (no wind) to clear 15 m. (50 ft.) 222 m. (730 ft.).
- Landing run (no wind) from 15 m. (50 ft.) 220 m. (720 ft.).

THE PIAGGIO P.148.

TYPE.—Three-seat Primary/Two-seat Aerobatic Trainer.

WINGS.—Cantilever low-wing monoplane. Wing section derived from NACA 230 and 4412. Aspect ratio 6.6. Taper ratio 2:1. Dihedral 6°. All-metal aluminium-alloy riveted single-spar structure with smooth skin covering. All-metal slotted ailerons and flaps. Total flap area 2.18 m.^{2} (23.6 sq. ft.). Total aileron area 1.52 m.^{2} (16.4 sq. ft.). Gross wing area 18.81 m.^{2} (203 sq. ft.).

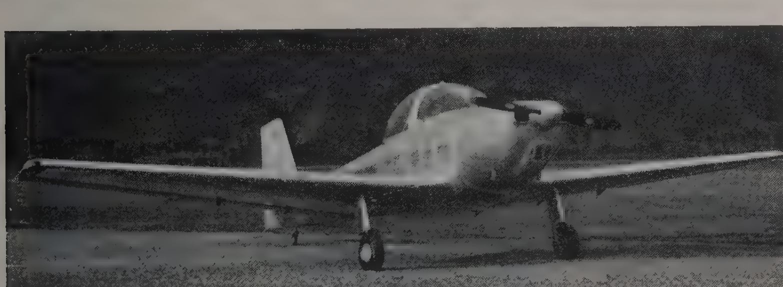
FUSELAGE.—Circular section structure. Aluminium-alloy stressed skin monocoque.

TAIL UNIT.—Cantilever monoplane type. Aluminium-alloy riveted structure. Fin area 0.66 m.^{2} (7.1 sq. ft.). Rudder area 0.84 m.^{2} (9 sq. ft.). Tailplane area 2.02 m.^{2} (21.7 sq. ft.). Total elevator area 1.52 m.^{2} (16.4 sq. ft.).

LANDING GEAR.—Non-retractable tail-wheel type. Oleo-pneumatic shock absorbers. Hydraulically operated wheel-brakes. Steerable tail-wheel. Track 2.90 m. (9 ft. 6 in.). Wheelbase 5.40 m. (17 ft. 9 in.).

POWER PLANT.—One 190 h.p. Lycoming O-435-A six-cylinder horizontally-opposed air-cooled engine driving a Piaggio P.1031 two-blade metal constant-speed airscrew. Two fuel tanks in wings, one on each side of fuselage, with total capacity of 169 litres (37 Imp. gallons).

ACCOMMODATION.—Two seats side-by-side with complete dual controls, and optional



The Piaggio P.148 Trainer (190 h.p. Lycoming engine).

third seat aft, all enclosed by transparent bubble canopy. Rear part of canopy slides backwards for access and may be released in flight for emergency exit Reinforced front windshield frame protects crew in event of nose-over landing.

Dimensions.—
- Span 11.12 m. (36 ft. 6 in.).
- Length overall 8.44 m. (27 ft. 8 in.).
- Height overall 2.40 m. (7 ft. 10½ in.).

Weights and Loadings.—
- Weight empty 876 kg. (1,931 lb.).
- Disposable load (two-seater) 324 kg. (714 lb.).
- Disposable load (three-seater) 404 kg. (891 lb.).
- Gross weight (two-seater) 1,200 kg. (2,645 lb.).
- Gross weight (three-seater) 1,280 kg. (2,822 lb.).
- Wing loading (two seater) 63.8 kg./m.^{2} (13.1 lb./sq. ft.).
- Wing loading (three-seater) 68.0 kg./m.^{2} (13.9 lb./sq. ft.).
- Power loading (two-seater) 6.32 kg./h.p. (13.9 lb./h.p.).
- Power loading (three-seater) 6.74 kg./h.p. (14.9 lb./h.p.).

Performance (two-seater aerobatic).—
- Max. speed at sea level 234 km.h. (145.4 m.p.h.).
- Max. speed at 2,000 m. (6,560 ft.) 223 km.h. (138.6 m.p.h.).
- Max. speed at 4,000 m. (13,120 ft.) 200 km.h. (124.3 m.p.h.).
- Cruising speed at 900 m. (2,953 ft.) 204 km.h. (126.8 m.p.h.).
- Climb to 1,000 m. (3,280 ft.) 3 min. 40 sec.
- Climb to 2,000 m. (6,560 ft.) 8 min. 10 sec.
- Climb to 3,000 m. (9,840 ft.) 15 min. 40 sec.
- Climb to 4,000 m. (13,120 ft.) 26 min. 40 sec.
- Service ceiling 5,000 m. (16,400 ft.).
- Take-off run (no wind) 135 m. (443 ft.).
- Landing run 150 m. (492 ft.).
- Landing speed 80 km.h. (49.7 m.p.h.).
- Duration (full tanks) 4.5 hours.
- Range (including starting, warming up, take-off and climb) 923 km. (573 miles).

Performance (three-seater).—
- Max. speed at sea level 232 km.h. (144.2 m.p.h.).
- Max. speed at 2,000 m. (6,560 ft.) 220 km.h. (137.3 m.p.h.).
- Max. speed at 4,000 m. (13,120 ft.) 198 km.h. (123.0 m.p.h.).
- Cruising speed at 900 m. (2,953 ft.) 201 km.h. (124.9 m.p.h.).
- Landing speed 83 km.h. (51.6 m.p.h.).
- Climb to 1,000 m. (3,280 ft.) 4 min. 30 sec.
- Climb to 2,000 m. (6,560 ft.) 11 min. 0 sec.
- Climb to 3,000 m. (9,840 ft.) 19 min. 0 sec.
- Service ceiling 4,400 m. (14,436 ft.).
- Duration (full tanks) 4 hours.
- Range (including allowance for starting, warming up, take-off and climb) 800 km. (497 miles).

The Piaggio P.136-L Amphibian (two 260 h.p. Lycoming engines).

- Take-off run (no wind) 194 m. (636 ft.).
- Landing run 180 m. (591 ft.).

THE PIAGGIO P.136-L and L-1.

In production for the Italian Air Force as an air/sea rescue amphibian, the P.136 is also available in two civil forms, the P.136-L and the P.136-L-1. Both are to be marketed in the United States by the Royal Aircraft Corporation as the Royal Gull.

Type.—Twin-engined Five-seat Amphibian Flying-boat.

Wings.—High-wing gull-shaped cantilever monoplane. NACA 230 wing section. Aspect ratio 7.4. Dihedral —21° 30′ inner gull portion, +2° 5′ outer wing. Chord 2.40 m. (7 ft. 10½ in.) root, 1.15 m. (3 ft. 9¼ in.) tip. All-metal aluminium-alloy riveted structure. Single-spar box type, smooth skin covering. All-metal slotted trailing-edge flaps. Metal-framed fabric-covered slotted ailerons. Total flap area 2.38 m.^{2} (25.6 sq. ft.). Total aileron area 1.95 m.^{2} (21 sq. ft.). Gross wing area 25.1 m.^{2} (270.2 sq. ft.).

Hull.—Two-step type. All-metal plated aluminium-alloy riveted semi-monocoque structure. Side floats attached to wing by single streamline strut.

Tail Unit.—Cantilever monoplane type. All-metal plated aluminium-alloy riveted structure. Tailplane and fin covered with smooth metal skin. Elevators and rudder fabric-covered. Trimming tabs in elevators and rudder. Fin area 1.81 m.^{2} (19.5 sq. ft.), rudder area 0.77 m.^{2} (8.3 sq. ft.), total elevator area 2.55 m.^{2} (27.4 sq. ft.), tailplane area 2.82 m.^{2} (30.5 sq. ft.).

Landing Gear.—Retractable type. Hydraulically operated. Oleo-pneumatic shock absorbers. Hydraulic wheel brakes. Track 2.54 m. (8 ft. 4 in.). Wheelbase 5.72 m. (18 ft. 9 in.).

Power Plant (P.136-L).—Two 260 h.p. Lycoming GO-435-C2 six-cylinder horizontally-opposed air-cooled engines. Three-blade Piaggio P.1033 constant-speed airscrews. Two fuel tanks in hull with total capacity of 720 litres (158.4 Imp. gallons=190.3 U.S. gallons).

Power Plant (P.136-L-1).—Two 270 h.p. Lycoming GO-480-B engines. Three-blade Piaggio P.1033 or Hartzell HC-83X20-2AL constant-speed full-feathering airscrews. Fuel capacity as above.

Accommodation.—Enclosed cabin seating two side-by-side in front and three on large seat aft. Dual controls. Two side doors. Right-hand panel of windshield fully openable for mooring, etc.

Dimensions.—
- Span 13.53 m. (44 ft. 4.7 in.).
- Length overall 10.80 m. (35 ft. 5 in.).
- Height overall 3.75 m. (12 ft. 3½ in.).

Weights and Loadings (P.136-L).—
- Weight empty 1,980 kg. (4,360 lb.).
- Disposable load 720 kg. (1,580 lb.).
- Weight loaded 2,700 kg. (5,940 lb.).
- Wing loading 107.5 kg./m.^{2} (22.0 lb./sq. ft.).
- Power loading, take-off 5.2 kg./h.p. (11.4 lb./h.p.).

Weights and Loadings (P.136-L-1).—
- Weight empty 1,930 kg. (4,254 lb.).
- Disposable load 792 kg. (1,746 lb.).
- Weight loaded 2,722 kg. (6,000 lb.).
- Wing loading 108.5 kg./m.^{2} (22.2 lb./sq. ft.).
- Power loading, take-off 5.04 kg./h.p. (11.1 lb./h.p.).

Performance (P.136-L at 1,980 kg.=4,360 lb. gross weight).—
- Max. speed at S/L 287 km.h. (178.3 m.p.h.).
- Cruising speed (67.5% rated power) 252 km.h. (156.6 m.p.h.) at 2,200 m. (7,218 ft.).
- Stalling speed (with flaps) 109 km.h. (67.7 m.p.h.).
- Service ceiling 5,400 m. (17,717 ft.).
- Range (payload 400 kg.=880 lb.) 600 km. (373 miles).
- Range (payload 200 kg.=440 lb.) 1,250 km. (777 miles).
- Max. range (55% power, full tanks) 1,900 km. (1,180 miles).

Performance (P.136-L-1 at 2,722 kg.=6,000 lb. gross weight).—
- Max. speed at S/L 294 km.h. (182.7 m.p.h.).
- Cruising speed (70% rated power) 265 km.h. (164.7 m.p.h.) at 2,400 m. (7,874 ft.).
- Stalling speed (with flaps) 110 km.h. (68.4 m.p.h.).
- Service ceiling 6,000 m. (19,685 ft.).
- Service ceiling (one engine) 1,400 m. (4,593 ft.).
- Range (payload 400 kg.=880 lb.) 700 km.h. (435 miles).
- Range (payload 200 kg.=440 lb.) 1,300 km. (808 miles).
- Max. range (55% rated power, full tanks) 1,700 km. (1,056 miles).


The Piaggio P.136-L-1 Amphibian (two 270 h.p. Lycoming engines).

SIAI-MARCHETTI

SOCIETÀ PER AZIONI SIAI-MARCHETTI.

Registered Office: Via della Posta, 3, Milan.

Management and Works: Sesto Calende (Varese).

Rome Office: Via Puccini, 10.

The SIAI-Marchetti company, formerly known as Savoia-Marchetti, has produced a wide range of military and civil aircraft covering both landplanes and flying-boats, and before the war devoted much attention to the development of the three-engined low-wing monoplane. Aeroplanes in this category included the SM.79 and SM.82 widely used by the *Regia Aeronautica* and the SM.75, SM.81 and SM.84, all of which have been described in previous issues of this work.

During the War the Company produced a number of experimental military aircraft, including the SM.91, SM.92 and SM.93.

After the War the Company built the SM.95 four-engined commercial monoplane, and the SM.102 twin-engined short-range passenger monoplane. Both these aircraft have been fully described and illustrated in previous editions of "All the World's Aircraft."

After suffering heavy financial losses owing to lack of government orders, SIAI-Marchetti went into liquidation in September, 1951. By the beginning of 1953 the company had practically overcome its financial difficulties, withdrew the liquidation and obtained several orders covering the full capacity of the aircraft works.

In the aircraft field, the company is overhauling and repairing various types of aircraft for the Italian Air Force, including the Beechcraft C-45, the Douglas C-47 and the Fairchild C-119.

JAPAN

FUJI

FUJI JUKOGYO KABUSHIKI KAISHA.
(Fuji Heavy Industries Co., Ltd.)

Head Office No. 18, 2-chome, Marunouchi, Chiyoda-ku, Tokyo.

Aircraft Factory: Utsunomiya, Tochigi Prefecture.

Aero-Engine Factories: Mitaka, Tokyo; Omiya, Saitama Prefecture.

President and Director: Kenji Kita.

Executive Director: Takao Yoshida.

Managing Directors: Tsunehiko Mitsumoto, Tomizo Fujiu, Takeo Kotani and Toshio Matsubayashi.

Fuji Heavy Industries, Co., Ltd. was established on July 15, 1953, and is essentially a successor to the Nakajima Aircraft Company, a pioneer in the field of aviation in Japan, established in 1914.

At the end of the war the Nakajima company was disbanded and the head office converted into the Fuji Saugyo Kabushiki Kaisha with the function of liquidating the various properties formerly held by Nakajima. Parallel to the establishment of this Company, twelve secondary companies were formed around the former Nakajima plants with the purpose of engaging in the production of peacetime products.

When the restrictions on aircraft manufacture were lifted with the signing of the peace treaty for Japan in 1952, five of the secondary companies decided to establish a company which would act as a parent company to lay the foundations upon which to re-engage in the production of aircraft. Each of the companies made equal investments in the new organisation with the understanding that it would eventually absorb the five companies. It was in this manner that Fuji Heavy Industries was born in July, 1953.

Under a licence and technical assistance agreement with the Beech Aircraft Corporation concluded in 1953, Fuji is building the Beechcraft Mentor at the Utsunomiya plant for the Japan Safety Forces. Beginning deliveries in August, 1954, Fuji now has a production capacity of 12 Mentors per month for the Japanese Air/Maritime Self-Defence Forces. Export to certain Asian air forces is expected in 1955/56.

A modified version of the Mentor with both military and civil uses is being developed. A multi-purpose liaison four-seat monoplane, the LM-1 Nikko was scheduled to go into production in the Summer of 1955.

Being designed is a jet trainer which is intended as an ultimate replacement for the Mentor. A prototype is expected to be completed in 1955.

Under a development contract from the Safety Forces, Fuji is proceeding with the design and construction of a radio-controlled target aircraft. Three prototypes of the HK-2B (Target Plane Type B) have been delivered for testing and evaluation to the Technical Research Institute of the Japanese Defence Agency. Upon the successful completion of this programme, a production order is expected.

At the time of writing negotiations were proceeding with the Continental Motors Corporation for a licence to manufacture Continental engines in Japan. The 225 h.p. Continental O-470 engine powers the Beechcraft Mentor.

Under a contract with the Japan Jet Engine Company experimental work has been proceeding since 1952 with a small turbojet, the JO-1, with a designed thrust of 1,000 kg. (2,200 lb.). Details of this engine will be found in the Engine Section.

The Fuji-Beech Mentor (225 h.p. Continental O-470 engine).

THE FUJI-BEECH MODEL B-45 MENTOR.

In 1953 Fuji was granted a licence to build the Model B-45 Mentor. The Fuji-Beech Mentor is essentially the same as the American version, being a two-seat Primary Trainer. The power-plant is the same, a 225 h.p. Continental O-470-13 six-cylinder horizontally-opposed air-cooled engine. For fuller details of the standard B-45 Mentor, see under Beechcraft (U.S.A.).

THE FUJI MODEL LM-1 NIKKO.

Freely adapted from the basic Model B-45 Mentor airframe, the new Model LM-1 Nikko differs only in interior modifications, including accommodation for four to six and an extra wing fuel tank of 18 U.S. gallons (68 litres). Dispensing with additional military training equipment has resulted in lower design weights and increased payload and gross loaded weight. Flying speeds are reduced and the general performance is lower.

The Fuji Model LM-1 Nikko was expected to go into limited production in the Summer of 1955.

Type.—Four to six seat general-purpose single-engine Cabin Monoplane.

Wings.—As Model B-45 Mentor.

Fuselage.—As Model B-45 Mentor except for modifications listed under "Accommodation."

Tail Unit and Landing Gear.—As Model B-45 Mentor.

Power Plant.—As Model B-45 Mentor. Additional to the two B-45 wing tanks of 25 U.S. gallons each (total 190 litres) is a third wing tank of 18 U.S. gallons (68 litres).

Accommodation.—Enclosed cabin seating a maximum of six; pilot in front on port side with conventional wheel control system, and three passengers, one beside the pilot and two side-by-side at back of cabin. Two additional emergency seats may be installed facing each other between the front and rear main seats. Maximum interior width of cabin 1.04 m. (41 in.), as against the 0.914 m. (36 in.) of the Model B-45 Mentor. Access door on the starboard side. Rear windows open for ground ventilation and have quick-release pins to permit their use as emergency exits. Cabin structure is reinforced for protection against turn-overs and is fitted with an auxiliary roof-opening bolted to the frame, which serves also as an emergency hatch over the auxiliary seats. Provisions have been incorporated in the design for the LM-1 to be quickly adapted for photographic survey, ambulance and light cargo duties.

Dimensions (As Model B-45 Mentor).

Weights and Loadings (Estimated).—
- Weight empty (full equipped) 978 kg. (2,156 lb.).
- Useful load 520 kg. (1,146 lb.).
- Weight loaded (normal) 1,435 kg. (3,164 lb.).
- Weight loaded (max.) 1,608 kg. (3,545 lb.).
- Wing loading (fully loaded) 87.02 kg./m.^{2} (17.82 lb./sq. ft.).
- Power loading (fully loaded) 6.38 kg./h.p. (14.05 lb./h.p.).

Performance (Estimated).—
- Max. speed at S/L 299 km.h. (186 m.p.h.).
- Cruising speed 258 km.h. (160 m.p.h.) at 2,300 m. (7,550 ft.).
- Stalling speed (flaps down) 89.2 km.h. (55.4 m.p.h.).
- Rate of climb at S/L 324 m./min. (1,063 ft./min.).
- Time to 1,525 m. (5,000 ft.) 6 min.
- Time to 3,050 m. (10,000 ft.) 14.3 min.
- Service ceiling 5,600 m. (18,370 ft.).
- Take-off run 284 m. (931 ft.).
- Take-off distance to clear 15 m. (50 ft.) 437 m. (1,438 ft.).
- Landing run 108 m. (354 ft.).
- Landing distance from 15 m. (50 ft.) 318 m. (1,043 ft.).

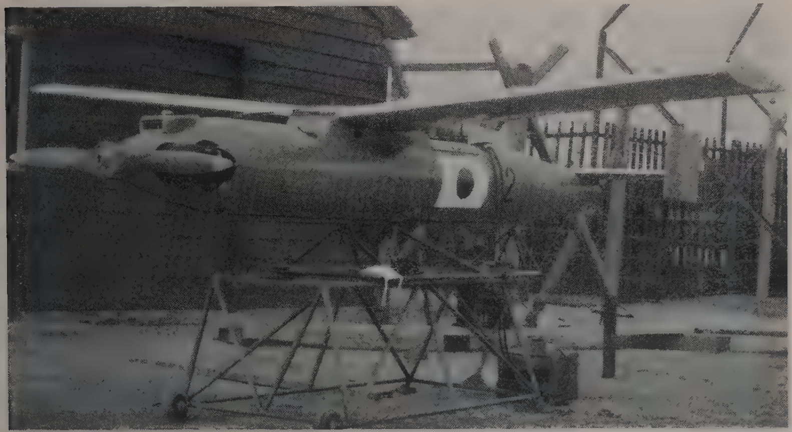
THE FUJI HK-2B.

Japanese Self-Defence Forces' designation: Target Plane Type B.

The Fuji HK-2B is a pilotless remotely-controlled parachute-recovery piston-engined target drone. The HK-2B is currently being tested by the Technical Research Institute of the Japanese Defence Agency which controls the Air/Maritime branches of the Self-Defence Forces. Three prototypes have been built.

Type.—Radio-controlled target drone.

Wings.—Shoulder-wing cantilever monoplane. NACA 642 A215 mod. aerofoil section. Aspect ratio 6.0. Chord 0.625 m. (2 ft. 1 in.). Dihedral 5°. Incidence 1° 59 min. Nil sweepback. Two-spar all-metal structure.



The Fuji HK-2B Type B Target Drone (72 h.p. McCulloch 4318 A engine).

Total area of metal covered ailerons 0.256 $m.^2$ (2.76 sq. ft.). Total wing area 2.305 $m.^2$ (24.8 sq. ft.).

FUSELAGE.—All-metal structure with circular cross-section.

TAIL UNIT.—Cantilever structure with rectangular end-plates and no rudders. Area of vertical surfaces 0.335 $m.^2$ (3.60 sq. ft.). Tailplane area 0.537 $m.^2$ (5.78 sq. ft.).

LANDING GEAR.—Ground launched from ramp. Recovery by parachute stowed internally immediately behind the shoulder-wing mounting.

POWER PLANT.—One 72 h.p. McCulloch Model 4318A four-cylinder horizontally-opposed air-cooled engine driving an all-wood fixed-pitch two-blade airscrew of 1.170 m. (3 ft. 10 in.) diameter. One fuel tank in the fuselage amidships with total capacity of 43 litres (11.4 U.S. gallons).

ACCOMMODATION.—In mid section of the fuselage is contained radio receivers and a R/C free-gyro auto-pilot plus battery and recovery parachute. The R/C equipment permits all normal manoeuvres including right and left turns, climb and descent.

DIMENSIONS.—
Span 3.720 m. (12 ft. $2\frac{1}{2}$ in.).
Length 3.855 m. (12 ft. $7\frac{3}{4}$ in.).
Height 0.700 m. (2 ft. $3\frac{1}{2}$ in.).

WEIGHTS AND LOADINGS.—
Weight empty (fully equipped) 86.0 kg (189.7 lb.).
Useful load 65.57 kg. (144.5 lb.).
Weight loaded (gross) 151.58 kg. (334.17 lb.).
Wing loading (fully equipped) 65.8 kg./$m.^2$ (13.5 lb./sq. ft.).
Power loading (fully equipped) 2.11 kg./h.p. (4.64 lb./h.p.).

PERFORMANCE (Estimated).—
Max. speed at S/L. 360 km.h. (224 m.p.h.).
Stalling speed 100 km.h. (62.5 m.p.h.).
Rate of climb 15.9 m./sec. (52.2 ft./sec.).
Time to 4,000 m. (13,125 ft.) 5 min. 46 sec.
Service ceiling 10,600 m. (34,800 ft.).
Endurance 1.0 hour.

KAWASAKI

KAWASAKI KOKUKI KABUSHIKI KAISHA (Kawasaki Aircraft Co., Ltd.).

HEAD OFFICE AND WORKS: P.O. Box 645, KOBE CENTRAL.

TOKYO BRANCH: SANKO BUILDING, 5, 2-CHOME, NISHI, GINZA, CHUO-KU.

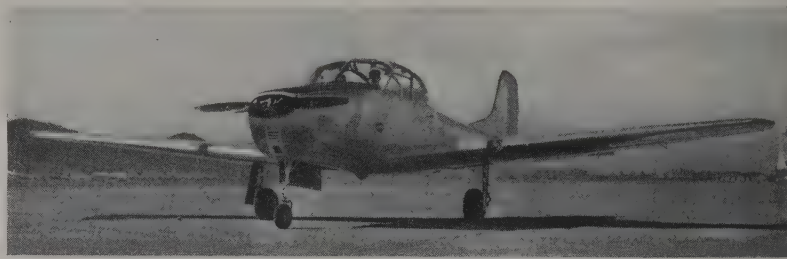
The former Kawasaki Kikai Kogyo Kabushiki Kaisha and Kawasaki Gifa Seisakusko Kabushik Kaisha were amalgamated under the name Kawasaki Kabushiki Kaisha (Kawasaki Aircraft Co., Ltd.) on March 15, 1954.

Kawasaki has signed a contract with the Lockheed Aircraft Service (Overseas) whereby it is permitted to repair and overhaul and, ultimately, manufacture the Lockheed F-94C all-weather fighter and the T-33A trainer. The contract covers the provision of all technical assistance needed in the maintenance, overhaul and manufacture of these two aircraft. Kawasaki is also overhauling jet engines for the United States Air Force.

Kawasaki has a licence to build the Bell Model 47 helicopter, and is also engaged in the manufacture of aircraft of original design.

THE KAWASAKI KAL-2.

Two prototype KAL-2's have been built at the request of the Japanese Defence Forces for liaison dutes. The first flew for the first time on November 25, 1954. This military version is powered by a Lycoming GO-435-C2 engine. For civil use, however, the GO-435-C2B engine will be used.


The Kawasaki KAL-2 (240 h.p. Lycoming GO-435-C2B engine).

TYPE.—Four/five-seat cabin monoplane.

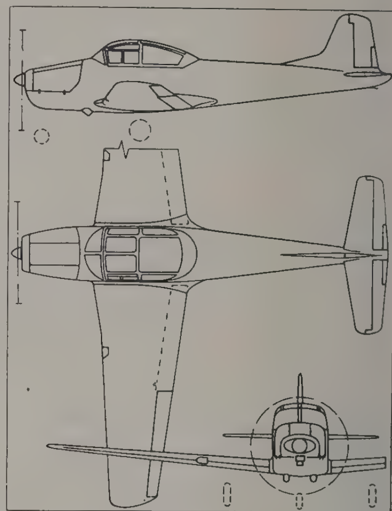
WINGS.—Low-wing cantilever monoplane. Wing section NACA2R1 16.5 at root, NACA 24010 at tip. Aspect ratio 7.2. Dihedral 5° 43′ at spar C/L. Chord 2.1 m. (6 ft. 11 in.) at root, 1.1 m. (3 ft. 7 in.) at tip. Mean aerodynamic chord 1.72 m. (5 ft. $7\frac{1}{2}$ in.). All-metal two-spar stressed-skin structure with flush-riveted skin over leading-edge. All-metal hydraulically-operated split trailing-edge flaps between ailerons and fuselage. Aluminium-alloy-framed fabric-covered mass-balanced ailerons. Total area of flaps 2.07 $m.^2$ (22.2 sq. ft.). Total area of ailerons 1.37 $m.^2$ (14.7 sq. ft.). Gross wing area 19.6 $m.^2$ (211 sq. ft.).

FUSELAGE.—Aluminium-alloy stressed-skin semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Metal framework, fabric covering and aerodynamically and statically balanced rudder and elevators. Controllable trim-tabs in rudder and elevators. Areas: fin 0.763 $m.^2$ (8.2 sq. ft.), rudder 0.647 $m.^2$ (7.0 sq. ft.), tailplane 2.015 $m.^2$ (21.7 sq. ft.), elevators 1.055 $m.^2$ (11.4 sq. ft.). Span of tailplane 3.70 m. (12 ft. $1\frac{3}{4}$ in.).

LANDING GEAR.—Retractable nose-wheel type. Air-oil shock absorbers. Steerable nose-wheel. Single-disc hydraulic brakes. Wheelbase 2.259 m. (7 ft. 8 in.). Track 3.396 m. (11 ft. $1\frac{1}{2}$ in.).

POWER PLANT.—One 240 h.p. Lycoming GO-435-C2B six-cylinder horizontally-opposed air-cooled engine. Hartzell two-blade metal variable-pitch airscrew 2.286 m. (7 ft. 6 in.) diameter. Fuel tanks (2) in wing roots forward of front spar. Total fuel capacity 300 litres (79 U.S. gallons).

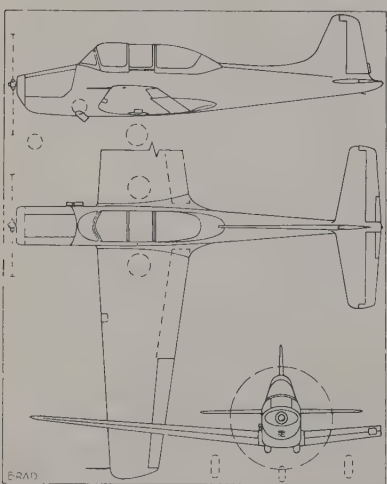

The Kawasaki KAL-2.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls in front and two or three passengers on full-width seat behind. Explosive-type door on starboard side for emergency exit. Emergency escape opening in fixed canopy roof above rear seats. Left window slides fore and aft. Baggage compartment behind rear seat and accessible in flight. Sound-proofing and controlled air-conditioning system.

DIMENSIONS.—
Span 11.924 m. (39 ft. $1\frac{1}{2}$ in.).
Length 8.820 m. (28 ft. $11\frac{1}{4}$ in.).
Height 2.694 m. (8 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty 1,110 kg. (2,450 lb.).
Weight loaded 1,600 kg. (3,530 lb.).
Wing loading 81.5 kg./$m.^2$ (16.8 lb./sq. ft.).
Power loading 6.6 kg./h.p. (14.7 kg./h.p.).

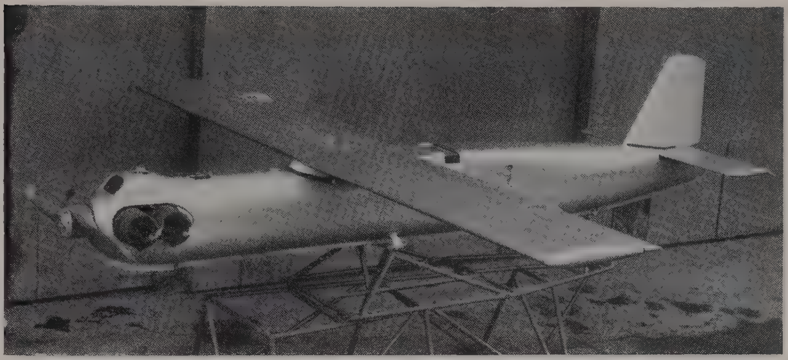
PERFORMANCE.—
Max. speed at S/L. 293 km.h. (182 m.p.h.).
Cruising speed (40% power) at 2,135 m. (7,000 ft.) 210 km.h. (130 m.p.h.).
Landing speed (with flaps) 87 km.h. (54 m.p.h.).
Initial rate of climb 280 m./min. (920 ft./min.).
Service ceiling 4,500 m. (14,800 ft.).
Max. cruising range (40% power) at 2,135 m. (7,000 ft.) 1,600 km. (1,000 miles).
Take-off distance to clear 15 m. (50 ft.) at S/L., no wind 350 m. (1,150 ft.).
Landing distance from 15 m. (50 ft.) at S/L., no wind 430 m. (1,410 ft.).


The Kawasaki KAT-1.

THE KAWASAKI KAT-1.

The KAT-1 is a two-seat primary trainer based on the previously-described KAL-2. The prototype KAT-1 made its first flight on February 11, 1954.


The Kawasaki KAT-1 (240 h.p. Lycoming GO-435-C2B engine).



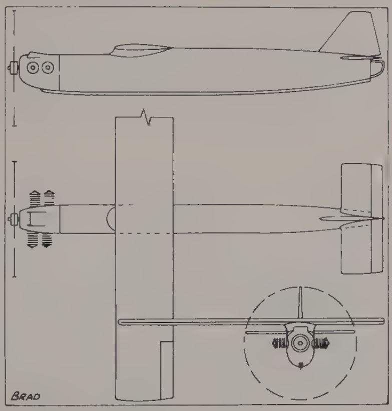
The Kawasaki KAQ-1 Target Drone (72 h.p. McCulloch 4318A engine).

TYPE.—Two-seat primary trainer.
WINGS.—Similar to KAL-2 except: Aspect ratio 7.1. Mean aerodynamic chord 1.62 m. (5 ft. 3¾ in.). Gross wing area 18.6 m.² (200.2 sq. ft.).
FUSELAGE.—Aluminium - alloy stressed - skin semi-monocoque structure.
TAIL UNIT.—Same as for KAL-2.
LANDING GEAR. — Retractable nose - wheel type. Oleo - pneumatic shock - absorbers. Single-disc hydraulic brakes. Wheelbase 2.280 m. (7 ft. 5¾ in.). Track 3.050 m. (10 ft.).
POWER PLANT.—Same as for KAL-2.
ACCOMMODATION.—Tandem cockpits under continuous canopy with sliding sections over each seat. Dual controls.
DIMENSIONS.—
Span 11.50 m. (37 ft. 8¾ in.).
Length 8.50 m. (27 ft. 10¾ in.).
Height 2.80 m. (9 ft. 2¼ in.).
WEIGHTS AND LOADINGS.—
Weight empty 1,070 kg. (2,360 lb.).
Weight loaded 1,385 kg. (3,053 lb.).
Wing loading 74.5 kg./m.² (15.3 lb./sq. ft.).
Power loading 5.8 kg./h.p. (12.7 lb./h.p.).
PERFORMANCE.—
Max. speed at S/L. 303 km.h. (188 m.p.h.).
Cruising speed (40% power) at 2,135 m. (7,000 ft.) 225 km.h. (140 m.p.h.).
Landing speed (with flaps) 83.5 km.h. (52 m.p.h.).
Initial rate of climb 334 m./min. (1,100 ft./min.).
Service ceiling 6,100 m. (20,000 ft.).
Max. cruising range (40% power) at 3,050 m. (10,000 ft.) 1,140 km. (710 miles).
Take-off run at S/L., no wind 168 m. (550 ft.).
Landing run at S/L., no wind 206 m. (680 ft.).

THE KAWASAKI KAQ-1.

The KAQ-1 is a radio-controlled target used primarily for anti-aircraft gunnery training. It is launched from a rotary launcher and landed by parachute.

TYPE.—Radio-controlled Target Drone.
WINGS.—Cantilever high-wing monoplane. Wing section NACA 2415 at root, NACA 2412 at tip. Aspect ratio 6.40. Chord (constant) 0.55 m. (21.6 in.). All-metal two-spar stressed-skin structure with normal ailerons and no flaps. Total area of ailerons 0.1212 m.² (1.3 sq. ft.). Gross wing area 1.91 m.² (20.6 sq. ft.).
FUSELAGE. — All - metal semi - monocoque structure.



The Kawasaki KAQ-1.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Areas: vertical surface 0.192 m.² (2.04 sq. ft.), tailplane 0.327 m.² (3.52 sq. ft.), elevators 0.107 m.² (1.15 sq. ft.). Tailplane span 1.10 m. (3 ft. 7 in.).
POWER PLANT.—One 72 h.p. McCulloch Model 4318A four-cylinder horizontally-opposed air-cooled engine. Engine set to run at optimum r.p.m. and speed cannot be varied by operator. Two-blade wood airscrew 1.170 m. (3 ft. 10 in.) diameter. Fuel tank in fuselage beneath wing. Fuel capacity 34 litres (9 U.S. gallons).
CONTROLS.—Automatic system operates ailerons and elevators. System comprises gyro, servo, mechanical linkage and interconnecting cables.
DIMENSIONS.—
Span 3.50 m. (11 ft. 6 in.).
Length 3.65 m. (12 ft.).
Height 0.805 m. (2 ft. 7½ in.).
WEIGHT.—
Gross weight 155 kg. (342 lb.).
PERFORMANCE.—
Max. speed at S/L. 354 km.h. (220 m.p.h.).
Launching speed 160 km.h. (99.5 m.p.h.).
Initial rate of climb 17.9 m./sec. (58.8 ft./sec.).
Max. range at S/L. 440 km. (274 miles).

MITSUBISHI

SHIN MITSUBISHI JUKOGYO KABUSHIKI KAISHA (Mitsubishi Heavy Industries Re-organised, Ltd.).

HEAD OFFICE: No. 1, 7-CHOME, WADAMIYADORI, HYOGO-KU, KOBE.

AIRCRAFT DEPARTMENT HEAD OFFICE: No. 14, 2-CHOME, MARUNOUCHI, CHIYODA-KU, TOKYO.

President: Shinzo Fujii.

Manager, Aircraft Department: Iwataro Nakagawa.

Up to the end of the war Mitsubishi was one of the largest manufacturers in Japan of aircraft and aero-engines and produced some 18,000 airframes and 50,000 aero-engines. Although the major part of the buildings at the Nagoya Engineering Works was damaged by air bombing during the war, the greater part of the machinery and equipment which had been evacuated and is now in use in the reconstructed shops.

A new plant was built in 1953 alongside the Komaki airfield which is being used by the U.S.A.F. In this plant Mitsubishi repairs and overhauls F-86's for the U.S. Far East Air Force. It expects to start the manufacture of F-86's in Japan in the near future. Mitsubishi also has an agreement with North American Aviation, Inc. granting the company limited rights to repair and manufacture spare parts for U.S.A.F. F-86 Sabre fighters stationed in Japan.

The company has a technical assistance and parts manufacturing agreement with Pratt & Whitney Aircraft Division of United Aircraft Corporation covering R-1340, R-1830, R-2000 and R-2800 engine parts. The Daiko aero-engine plant at Nagoya has been approved by the United States C.A.A. as a aircraft engine repair station.

Another agreement exists with Sikorsky Aircraft Division of United Aircraft Corporation for technical collaboration in the maintenance of S-55 helicopters and manufacturing rights for S-55 components. Mitsubishi has assembled and overhauled a number of S-55's for the Japanese Maritime Safety Board and the Japanese Self-Defence Forces.

Plans have been completed by the company for the trial manufacture of light jet trainers intended for the Japanese Self Defence Forces. Fundamental studies and researches having been completed, the basic design been finalized, and wind tunnel and load tests are being conducted. It is confidently expected that the first light jet trainers under this scheme, to be known as the JT-M1, will make their debut in 1957.

OKAMURA

OKAMURA SEISAKUJO KABUSHIKI KAISHA (Okamura Manufacturing Co., Ltd.).

HEAD OFFICE AND WORKS: No. 120, 2-CHOME, KITASAIWAI-CHO, NISHI-KU, YOKOHAMA.

OKAMURA BRANCH WORKS: No. 1515, KOSHIGOE, OKAMURA-CHO, ISOGO-KU, YOKAHAMA.

TOKYO OFFICE: No. 4, 4-CHOME, SHINBASHI MINATO-KU, TOKYO.

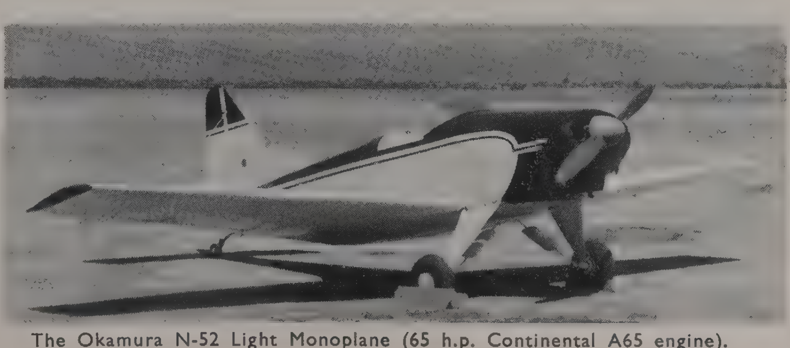
Managing Director: Kenjiro Yoshihara.

This company was one of the branch works of the Nihon Aircraft Works which was building training aircraft for the Japanese Navy before the end of the war.

In 1952 Okamura began light aircraft manufacture. Its first product, the N-52 two-seat light monoplane, which was built to the original designs of Professor H. Kimura of Nihon University, made its first flight on April 7, 1953.

THE OKAMURA N-52.

TYPE.—Two-seat light monoplane.
WINGS.—Low-wing cantilever monoplane. Japanese F5 *Mbis* 3015 wing section at root, 3009 at tips. Incidence 3°. Dihedral 5°. Chord 1.80 m. (5 ft. 11 in.) at root, 0.9 m. (2 ft. 11 in.) at tip. One piece wing attached to fuselage by four bolts. One main and one auxiliary spars, girder wooden ribs, plywood leading-edge and overall fabric covering. Frise type ailerons. No flaps. Total aileron area 0.99 m.² (10.7 sq. ft.).



The Okamura N-52 Light Monoplane (65 h.p. Continental A65 engine).

Gross wing area 12.0 m.^{2} (129 sq. ft.).

FUSELAGE.—Welded steel tube structure covered with fabric over wood formers. Maximum width 1.10 m. (3 ft. 7 in.).

TAIL UNIT.—Braced monoplane type. Welded steel tube frames covered with fabric. One-piece tailplane strut-braced below and wire-braced above. One-piece elevator with trim-tab. Total horizontal area 2.2 m.^{2} (23.7 sq. ft.). Total vertical area 1.0 m.^{2} (10.8 sq. ft.). Span of tail 3.0 m. (9 ft. 10 in.).

LANDING GEAR.—Fixed tail-wheel type. Main wheels on half axles with rubber cord springing. Leaf-spring tail-wheel. Track 2.0 m. (6 ft. 5¾ in.).

POWER PLANT.—One 65 h.p. Continental A65, or 85 h.p. C85, four-cylinder horizontally-opposed air-cooled engine. Two-blade wood airscrew, 1.76 m. (5 ft. 9 in.) diameter. Fuel tank (50 litres = 11 Imp. gal.) in fuselage.

ACCOMMODATION.—Open cockpit seating two side-by-side with dual controls.

DIMENSIONS.—
Span 8.60 m. (28 ft. 2½ in.).
Length 6.00 m. (19 ft. 8 in.).
Height 2.60 m. (8 ft. 6 in.).

WEIGHTS AND LOADINGS (65 h.p. Continental engine).—
Weight empty 300 kg. (660 lb.).
Weight loaded 500 kg. (1,100 lb.).
Wing loading 41.7 kg./m.^{2} (8.5 lb./sq. ft.).
Power loading 7.7 kg./h.p. (16.9 lb./h.p.).

WEIGHTS AND LOADINGS (85 h.p. Continental engine).—
Weight empty 320 kg. (704 lb.).
Weight loaded 535 kg. (1,177 lb.).
Wing loading 44.6 kg./m.^{2} (9.14 lb./sq. ft.).
Power loading 6.3 kg./h.p. (13.8 lb./h.p.).

PERFORMANCE (65 h.p. Continental engine).—
Max. speed at S/L. 175 km.h. (108 m.p.h.).
Cruising speed at S/L. 163 km.h. (101 m.p.h.).
Stalling speed 79 km.h. (49 m.p.h.).
Initial rate of climb 167 m./min. (550 ft./min.).
Service ceiling 4,150 m. (13,610 ft.).
Range at S/L. 490 km. (305 miles).
Take-off run 135 m. (147 yds.).

PERFORMANCE (85 h.p. Continental engine).—
Max. speed at S/L. 192 km.h. (119 m.p.h.).
Cruising speed at S/L. 177 km.h. (110 m.p.h.).
Stalling speed 82 km.h. (51 m.p.h.).
Initial rate of climb 235 m./min. (770 ft./min.).
Service ceiling 5,000 m. (16,400 ft.).
Range at S/L. 490 km. (305 miles).
Take-off run 120 m. (130 yds.).

SHOWA

SHOWA HIKOKI KOGYO KABUSHIKI KAISHA (Showa Aircraft Industry Co., Ltd.).

HEAD OFFICE: No. 1, 2-CHOME, MURO-MACHI, NIHONBASHI, CHUO-KU, TOKYO.

WORKS: No. 600, TANAKA-MACHI, AKISHIMA-CITY, TOKYO.

President: Kumezo Ishizuka.

Managing Director: Shinji Iwabuchi.

Managing Director: Kiyoshi Mackawa.

Showa, which, before the war, was responsible for the manufacture of the Douglas DC-3 under licence, was the first Japanese aircraft manufacturing company to resume post-war operations when it undertook the overhaul and repair of aircraft of the Far East Air Force under contract with the U.S. Government.

While continuing with the overhaul and repair of U.S.A.F. aircraft, helicopters and aero-engines, the company is erecting a new factory and is making preparations for the production of some kind of aircraft, in addition to continuing with repair and maintenance work.

TACHIKAWA

SHIN TACHIKAWA KOKUKI KABUSHIKI KAISHA (New Tachikawa Aircraft Co., Ltd.).

HEAD OFFICE: No. 100 1-CHOME, TAKAMATSU-CHO, TACHIKAWA-SHI, TOKYO.

FACTORIES: TACHIKAWA AND SUNAGAWA.

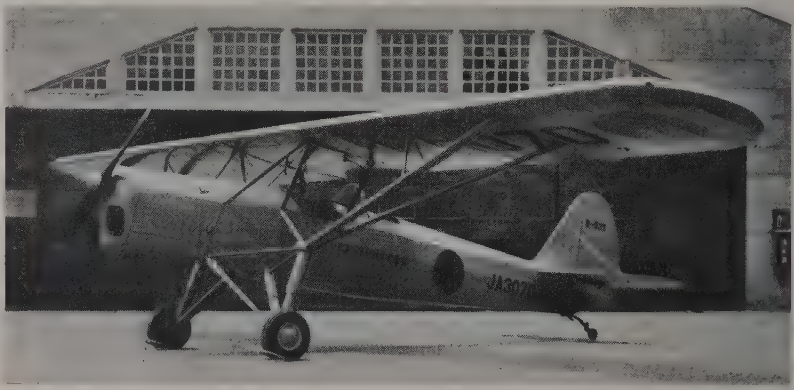
President: Yoshio Kawasaki.

The New Tachikawa Aircraft Company was established on November 15, 1949, as the second reconstructed company of the former Tachikawa Aircraft Co., Ltd.

As all the factory area of the former Tachikawa company has been in use by the U.S. Air Force since September 4, 1945, the company has built a new factory at Sumagawa, outside the former factory area.

As soon as the Air Law permitting the manufacture of aircraft was published on July 15, 1952, the company began the design of its first aeroplane, the R-52. The R-52 was completed in September, 1952 and was the first aircraft built entirely of Japanese materials and powered by a Japanese engine to be completed since the war.

A revised version, the R-53, has since been built and is described hereunder.



The Tachihi R-53 Two-seat Trainer (155 h.p. Cirrus Major engine).

THE TACHIHI R-53.

TYPE.—Two-seat Trainer.

WINGS.—High-wing strut-braced monoplane. NACA 23012 wing section. Aspect ratio 6.62. Dihedral nil. Two Japanese cypress spars, pressed duralumin ribs and fabric covering. No flaps on slots. Gross wing area 17.3 m.^{2} (186 sq. ft.).

FUSELAGE.—Welded steel tube structure covered with fabric.

TAIL UNIT.—Strut-braced monoplane type. Welded steel tube framework with fabric covering. Trim-tab in elevator. Areas: fin 1.5 m.^{2} (16.14 sq. ft.), rudder 1.0 m.^{2} (10.75 sq. ft.), horizontal tail area 2.5 m.^{2} (26.9 sq. ft.). Tailplane span 3.376 m. (11 ft.).

LANDING GEAR.—Fixed tail-wheel type. Oil spring shock-absorber struts. Wheel brakes. Steerable tail-wheel with spring steel shock-absorber.

POWER PLANT.—One 155 h.p. Blackburn Cirrus Major four-cylinder in-line inverted air-cooled engine. Two-blade fixed-pitch wood airscrew 2.04 m. (6 ft. 8 in.) diameter. Fuel tank (140 litres = 30.8 Imp. gallons) in centre-section of wing.

ACCOMMODATION. — Tandem open cockpits with dual controls.

DIMENSIONS.—
Span 10.7 m. (35 ft. 1 in.).
Length 7.55 m. (24 ft. 6 in.).
Height 2.65 m. (8 ft. 2 in.).

WEIGHTS.—
Weight empty 668 kg. (1,470 lb.).
Disposable load 282 kg. (620 lb.).
Weight loaded 950 kg. (2,094 lb.).

PERFORMANCE.—
Max. speed 208 km.h. (129 m.p.h.).
Cruising speed 145 km.h. (90 m.p.h.).
Stalling speed 79 km.h. (49 m.p.h.).
Service ceiling 4,350 m. (14,270 ft.).
Range 750 km. (466 miles).
T.O. distance to 15 m. (50 ft.) 421 m. (461 yds.).
Landing distance from 15 m. (50 ft.) 466 m. (510 yds.).

The Tachihi R-HM (90 h.p. Continental C90 engine).

THE TACHIHI R-HM.

The R-HM was built under the direction of M. Henri Mignet, the designer of the controversial Pou-du-Ciel. Although the R-HM is similar in external appearance to the H.M.310 which M. Mignet built in Brazil in 1950 it is claimed that the Japanese version is improved in many respects.

TYPE.—Two-seat light aircraft.

WINGS.—Consist of surfaces of unequal span so positioned to provide a slot or gap effect between the trailing-edge of the forward wing and the leading-edge of the rear wing. Forward wing has variable incidence controllable by direct connection with the control column. Rear wing is fixed but provided with trailing-edge trimming surface of 0.31 m.^{2} (3.34 sq. ft.) area. NACA 23012 (modified) wing section on both surfaces. Chord (both surfaces) 1.50 m. (4 ft. 11 in.). Both surfaces are single-spar fabric-covered structures. Outer sections of both wings hinged to fold up for storage. Gross wing area 18.72 m.^{2} (201.5 sq. ft.).

FUSELAGE.—Welded steel-tube structure with fabric covering.

TAIL UNIT.—Vertical rudder only. Area 0.9 m.^{2} (9.65 sq. ft.).

LANDING GEAR.—Fixed type. Rubber-cord springing. Goodyear wheels and brakes. Steerable tail-wheel.

POWER PLANT.—One 90 h.p. Continental C90-12F four-cylinder horizontally-opposed

air-cooled engine. Met-L-Prop two-blade airscrews. Fuel tank (100 litres=22 Imp. gallons) in fuselage.
Accommodation.—Enclosed cockpit seating two side-by-side.

Dimensions.—
Span of front wing 8.0 m. (26 ft. 1 in.).
Span of rear wing 5.76 m. (18 ft. 9 in.).
Overall length 5.08 m. (16 ft. 8 in.).
Height 2.00 m. (6 ft. 6 in.).

Weights.—
Weight empty 413 kg. (910 lb.).
Weight loaded 645 kg. (1,420 lb.).
Performance.—
Cruising speed 115 km.h. (71.5 m.p.h.).
Landing speed 50 km.h. (31.1 m.p.h.).

TOYO

TOYO KOKU KABUSHIKI KAISHA (Toyo Aircraft Manufacturing Company Ltd.).

Head Office: Nikkatsu International Building, Yuraku-cho, Chiyoda-Ku, Tokyo.

Parts Shop: 5021, Tofsuka-cho, Tofsuka-ku, Yokohama.

Assembly Shop and Airstrip: Ohara, Fujisawa, Kanagawa Prefecture.

President: Shigemi Yokoo.

Vice-President and Managing Director: Shingo Ishikawa.

Director of Technical Services and Chief Engineer: Yoshio Hashiguchi.

The Toyo Aircraft Manufacturing Company was formed on June 10, 1952, by Shigemi Yokoo, a former Minister of International Trade and Industry; Shingo Ishikawa, a former admiral of the Imperial Japanese Navy; and Yoshio Hashiguchi, who was formerly managing director and chief engineer of the Kawasaki Aircraft Company.

The company's first aircraft, the Type TT-10, made its first flight on December 30, 1952. The first production TT-10 flew on February 11, 1953.

Toyo holds the manufacturing and sales licences for the FD-25 and FD-25A from the Fletcher Aviation Corporation of Pasadena, California, U.S.A. These aircraft are now in production. A description of the FD-25 will be found under "Fletcher" (U.S.A.).

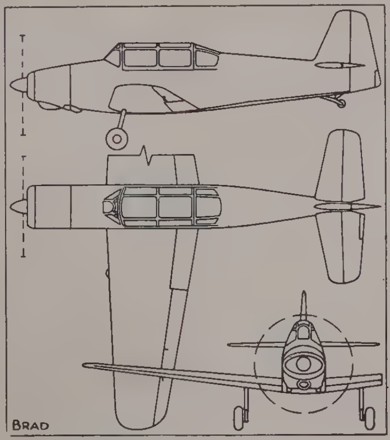
The Fletcher Aviation Corporation is a stock participant in Toyo, as is the Air Carrier Service Corporation of Washington, D.C. The Air Carrier Service Corporation are export representatives for Toyo and also act as purchasing and technical agents for Toyo in the United States.

In addition to building complete aircraft Toyo is also engaged in general aircraft overhaul and maintenance work.

THE TOYO TT-10.

Type.—Two-seat Light Trainer.
Wings.—Low-wing cantilever monoplane. Wing sections NACA 1415 at root, NACA 2410 (modified) at tip. Aspect ratio 6. Chord 1.82 m. (5 ft. 11 in.) at root, 1.37 m. (4 ft. 6 in.) mean. Dihedral 6°. Incidence 2°30′ at root, 1°30′ at tip. Two-spar all-wood structure with plywood skin and final covering of fabric. Flaps and ailerons have wood framework and fabric covering.

The Toyo TT-10 Light Trainer (140 h.p. Lycoming O-290 engine).



The Toyo TT-10 Light Trainer.

Total area of flaps 0.78 m.² (8.4 sq. ft.).
Total aileron area 1.11 m.² (12 sq. ft.).
Gross wing area 12 m.² (128 sq. ft.).
Fuselage.—Welded chrome-molybdenum steel tube framework with fabric covering.
Tail Unit.—Cantilever monoplane type. All wood structure with fabric covering or all-metal construction. Areas: fin 0.9 m.² (9.7 sq. ft.), rudder 0.4 m.² (4.35 sq. ft.), tailplane 1.09 m.² (11.8 sq. ft.), elevators 0.9 m.² (9.7 sq. ft.). Tailplane span 2.9 m. (9 ft. 9 in.).

Landing Gear.—Fixed tail-wheel type. Oleo-pneumatic shock absorbers. Goodrich wheels and toe-operated hydraulic brakes. Tail-wheel has coil-spring shock-absorber. Track-wheel has coil-spring shock-absorber. Track 2.48 m. (8 ft. 2 in.).
Power Plant.—One 140 h.p. Lycoming O-290-D2 four-cylinder horizontally-opposed air-cooled engine. Sensenich CS3FM4/C374 two-blade fixed-pitch airscrew. Fuel tank in fuselage. Total fuel capacity 23.8 gallons (90 litres).
Accommodation.—Tandem seats under continuous canopy with sliding sections over both seats. Dual controls.
Dimensions.—
Span 8.60 m. (28 ft. 2 in.).
Length 7.15 m. (23 ft. 5 in.).
Height (tail down) 2.10 m. (6 ft. 10 in.).
Weights and Loadings.—
Weight empty 568 kg. (1,240 lb.).
Weight loaded 800 kg. (1,760 lb.).
Wing loading 67 kg./m.² (13.9 lb./sq. ft.).
Power loading 5.94 kg./h.p. (13.1 lb./h.p.).
Performance.—
Max. speed at S/L. 235 km.h. (147 m.p.h.).
Cruising speed 190 km.h. (119 m.p.h.).
Stalling speed (without flaps) 92 km.h. (57.5 m.p.h.).
Stalling speed (30° flap) 80 km.h. (50 m.p.h.).
Initial rate of climb 228 m./min. (750 ft./min.).
Service ceiling 4,300 m. (14,100 ft.).
Absolute ceiling 5,000 m. (16,400 ft.).
Cruising range 760 km. (470 miles).
Take-off distance to clear 15.25 m. (50 ft.) 290 m. (950 ft.).
Landing distance from 15.25 m. (50 ft.) 300 m. (985 ft.).

NETHERLANDS

FOKKER

THE N.V. KONINKLIJKE NEDERLANDSCHE VLIEGTUIGENFABRIEK FOKKER (Royal Netherlands Aircraft Factories Fokker).

HEAD OFFICE AND MAIN FACTORY: SCHIPHOL-ZUID, AMSTERDAM.

OTHER FACTORIES: AMSTERDAM-NOORD, YPENBURG NEAR THE HAGUE, AND DORDRECHT.

Director in charge of Administration and Finance: H. During.

Technical Director: Prof. ir. E. van Emden.

Sales Director: F. J. L. Diepen.

Assistant Director and Chief Designer: ir. H. C. van Meerten.

The Fokker works at Amsterdam were founded at Amsterdam in 1919 by the late A. H. G. Fokker, the well-known aircraft designer, who died on December 23, 1939.

Up to the time of the invasion of Holland in May, 1940, the Fokker Company had produced a wide range of commercial and military aircraft of all-metal and mixed construction which found a ready sale in the World's markets.

After having rebuilt the war-damaged factory in the north of Amsterdam, a new factory was built in 1951 on the Schiphol Airport, where the main production takes place.

In 1954 the Fokker company enlarged its facilities by the acquisition of the Avio-Diepen Industrie Mij. N.V. at Ypenburg and the former Aviation Section of the "De Schelde" factory at Dordrecht.

The current types of Fokker aircraft built or under construction are the S.11 Instructor two-seat basic trainer; the S.12, a nose-wheel version of the S.11; the S.14 Mach-Trainer Mk. I two-seat transition jet trainer powered by a Rolls-Royce Derwent engine; the S.14 Mach-Trainer Mk. II with the Rolls-Royce Nene engine; and the F.27 Friendship 28/36-passenger twin-turboprop airliners.

The S.11 Instructor is in service in the Netherlands, Israel and Italian Air Forces. The Italian Macchi company builds the Instructor under licence under the designation M.416.

In Brazil Fokker Indústria Aéronautica S.A., with works at the Galeão Airport, Rio de Janeiro, is building a series of 100 S.11 Instructors for the Brazilian Air Force. It will also put into production the S.12 and the S.14 Mach-Trainer Mk. I, both in series of fifty.

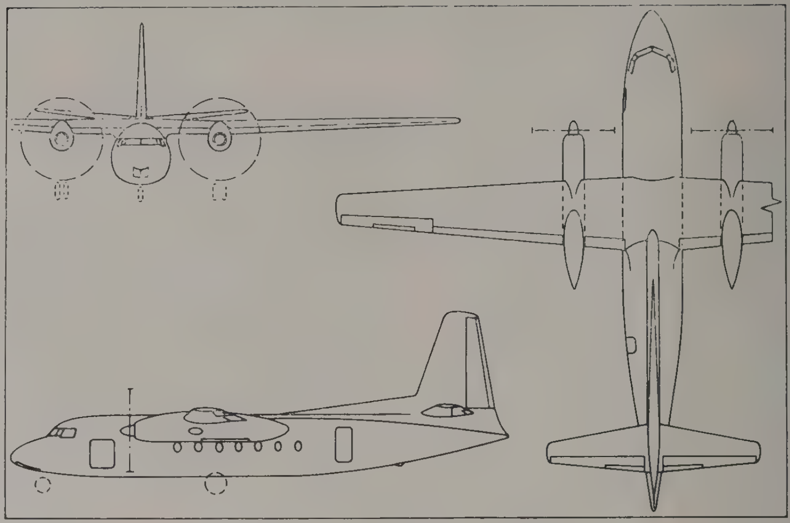
The American Fairchild Engine and Airplane Corporation holds an option on a licence to build the F.27 Friendship.

Fokker holds licences to build the Hawker Sea Fury, a series of which has been built for the Royal Netherlands Navy; the Gloster Meteor Mk. 8, of which 330 have been delivered to the Netherlands and Belgian Air Forces; and the Hawker Hunter. A large number of Hunters will be built for Holland, Belgium and, under off-shore procurement, for the United States in close co-operation with the Aviolanda company and the Belgian industry.

THE FOKKER F.27 FRIENDSHIP.

The F.27 has been designed as a medium-sized airliner suitable for short to medium range continental traffic. Two prototypes are being built, the first of which was due to make its first flight in the Summer of 1955. Preparations for quantity production have already started.

The F.27 is a high-wing cantilever monoplane with standard seating for 28 passengers in backward-facing seats in a pressurised cabin. Forward-facing seats can eventually be installed. For short range high-density traffic the number of seats may be increased to 32 and 36. The low floor level, large cargo holds and a removable front cabin wall make the F.27 well suited to those local services with many intermediate stops, where quick and simple loading and adaptation to ever-changing load demands are of importance.



The Fokker F.27 Friendship Airliner.

The F.27 will be powered by two 1,600 h.p. Rolls-Royce Dart RDa.6 engines, but the newer types of the Dart can eventually be fitted.

K.L.M. Royal Dutch Airlines have ordered an initial batch of F.27's for their continental operations and negotiations with other airlines are proceeding.

TYPE.—Twin turboprop-engined 28/36 passenger Airliner.

WINGS.—High-wing cantilever monoplane. NACA 6 Series wing section. Aspect ratio 12. Taper ratio 0.4. Chord 3.45 m. (11 ft. 4 in.), at root 1.4 m. (4 ft. 7 in.) at tip. All-metal two-spar stressed-skin structure consisting of centre-section and two detachable outer sections. Entire leading-edge sections detachable. Thermal anti-icing through electric heat-exchanger. Electrically-operated compound double-slotted flaps between ailerons and fuselage but divided by engine nacelles. Slotted ailerons. Gross wing area 70 m.² (754 sq. ft.).

FUSELAGE.—All-metal stressed-skin structure. Between rear bulkhead of nose-wheel compartment and the circular pressure bulkhead aft of the luggage compartment the fuselage is pressurised to a differential of 4.16 lb./sq. in. (0.29 kg./cm.²). Length of pressurised section 15.24 m. (50 ft.). Diameter of fuselage 2.7 m. (8 ft. 10 in.). The slightly flattened fuselage bottom is reinforced by special under-floor members.

TAIL UNIT.—Cantilever monoplane type. All-metal stressed-skin structure. Fin and tailplane, as well as leading-edges of surfaces, are detachable. Thermal anti-icing. Total area of vertical surfaces 1.19 m.² (129 sq. ft.), of horizontal surfaces 1.59 m.² (172 sq. ft.). Span of tail 9.8 m. (32 ft. 2 in.).

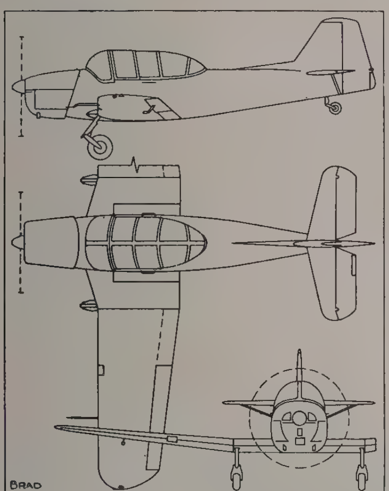
LANDING GEAR.—Retractable tricycle type. Pneumatic retraction. All units of twin-wheel type. Main units retract backward into engine nacelles, nose unit forward into non-pressurised nose cone. Pneumatic brakes on main wheels, which also have Dunlop Maxaret automatic anti-skid system. Wheelbase 7.62 m. (25 ft.). Track of main units (between centre-lines of shock struts) 7.19 m. (23 ft. 7½ in.).

POWER PLANT.—Two Rolls-Royce Dart (RDa 6 rating) turboprop engines, each developing 1,550 s.h.p. plus 166 kg. (365 lb.) s.t. for take-off and a maximum continuous power of 1,245 s.h.p. plus 134 kg. (295 lb.) s.t. at sea level. Four-blade airscrews 3.66 m. (12 ft.) diameter. Integral fuel tanks in outer wings. Total fuel capacity 3,200 litres (704 Imp. gallons). Overwing fueling but underwing system can be installed on request. Methyl-bromide fire-prevention system with flame detectors and crash-inertia switches.

ACCOMMODATION.—Flight compartment seats two side-by-side. Main cabin has standard seating capacity for 28 passengers in backward-facing seats, but alternative arrangements allow this number to be decreased to 24 or increased to 32 by moving front cabin bulkhead. A further 4 seats can be added by moving rear cabin bulkhead and transferring pantry to forward cargo compartment. Pressurisation at 4.16 lb./sq. in. allows a cabin altitude of 2,440 m. (8,000 ft.) to be maintained up to a height of 6,100 m. (20,000 ft.). Air-conditioning and heating. Volume of forward cargo compartment 7.89 m.³ (282 cub. ft.) in standard 28-passenger version, 5.5 m.³ (192 cub. ft.) in 24 passenger de-luxe version 5.12 m.³ (183 cub. ft.) in 32-passenger version, and 4.95 m.³ (177 cub. ft.) in

Two Fokker S.11 Instructor Trainers of the Royal Netherland Air Force.

The Fokker S.11 Instructor (190 h.p. Lycoming O-435A engine).



The Fokker S.11 Instructor.

36-passenger version. Volume of rear baggage compartment 2.8 m.^{3} (100 cub. ft.) in all versions. Entrance door, toilet, pantry and stewardess' seat aft of cabin in all except 36-passenger version where the pantry is relocated in forward cargo compartment.

Equipment.—Pneumatic system for landing-gear retraction and brakes, with separate emergency system. Two separate electrical systems to provide power for flaps, anti-icing, radio, etc. Standard radio equipment includes VHF and HF receiver/transmitters, automatic D/F radio-compass, ILS and intercommunications system. 750-litre oxygen system available for pilots.

Dimensions.—
- Span 29.0 m. (95 ft.).
- Length 22.3 m. (73 ft.).
- Height 8.1 m. (26 ft. 6 in.).

Weights (28-passenger version).—
- Weight empty 9,349 kg. (20,610 lb.).
- Crew (3) 215 kg. (473 lb.).
- Equipment 110 kg. (242 lb.).
- Normal disposable load (fuel and oil plus payload) 5,128 kg. (11,305 lb.).
- Normal take-off weight 14,801 kg. (32,630 lb.).
- Max. permissible take-off weight 15,513 kg. (34,200 lb.).
- Max. landing weight 14,801 kg. (32,630 lb.).
- Normal wing loading 211 kg./m.^{2} (43.3 lb./sq. ft.).
- Normal power loading 4.4 kg./e.h.p. (9.7 lb./e.h.p.).

Performance.—
- Max. cruising speed 450 km.h. (280 m.p.h.) at 6,100 m. (20,000 ft.).
- Econ. cruising speed 428 km.h. (266 m.p.h.) at 6,100 m. (20,000 ft.).
- Initial rate of climb at S/L. 460 m./min. (1,500 ft./min.).
- Service ceiling 10,700 m. (35,000 ft.).
- Operating height on one engine 3,810 m. (12,500 ft.).
- Normal stage distance at 327 km.h. (203 m.p.h.) 480 km. (300 miles).
- Max. stage distance 1,600 km. (1,000 miles).
- Take-off distance to clear 15.25 m. (50 ft.) 1,160 m. (1,270 yds.).
- Landing distance from 15.25 m. (50 ft.) 1,160 m. (1,270 yds.).

THE FOKKER S.11 INSTRUCTOR.

Type.—Two-seat Basic Trainer.

Wings.—Cantilever low-wing monoplane. All-metal one-piece structure. Manually-operated light-metal landing flaps. Metal-framed fabric-covered ailerons. Wing area 18.5 m.^{2} (199 sq. ft.).

Fuselage.—Welded steel-tube structure with fabric covering.

Tail Unit.—Braced monoplane type. Fin integral with fuselage. All-metal tailplane mounted half-way up fin and braced to fuselage by single strut on each side. Horn-balanced rudder and elevators have metal frames and fabric covering. Controllable elevator trim-tab ; rudder trim-tab adjustable on ground.

Landing Gear.—Fixed two-wheel type. Main wheels each carried on Olaer levered-suspension cantilever leg. Hydraulic wheel-brakes. Steerable tail-wheel.

Power Plant.—One 190 h.p. Lycoming O-435A six-cylinder horizontally-opposed air-cooled engine on welded steel-tube bearer and driving two-blade fixed-pitch wooden airscrew. Alternatively an Aeromatic automatically-adjustable-pitch airscrew may be fitted. Two Goodyear Pliocel fuel tanks in wings one on each side of fuselage, with total capacity of 141 litres (31 Imp. gallons).

Accommodation.—Two seats side-by-side with dual controls. Perspex canopy slides backwards for access. Heavy arch between front and rear seats to protect occupants.

Equipment.—Full instrument equipment. Fire-extinguisher behind engine. Electrical system for instrument board and navigation instrument lighting and operation, as well as starter.

Dimensions.—
- Span 11.0 m. (36 ft. 1 in.).
- Length 8.18 m. (26 ft. 8 in.).
- Height 2.70 m. (7 ft. 10.5 in.).

Weights and Loadings (fixed-pitch airscrew).—
- Weight empty (equipped) 810 kg. (1,785 lb.).
- Crew (two, with parachutes) 180 kg. (396 lb.).
- Fuel and oil 110 kg. (243 lb.).
- Normal weight loaded 1,100 kg. (2,425 lb.).
- Wing loading (normal) 59.5 kg./m.^{2} (12.2 lb./sq. ft.).
- Power loading (normal) 5.8 kg./h.p. (12.8 lb./h.p.).

Performance (fixed-pitch airscrew).—
- Max. speed 209 km.h. (130 m.p.h.).
- Cruising speed 164 km.h. (102 m.p.h.).
- Climb to 1,000 m. (3,280 ft.) 5.6 min.
- Climb to 2,000 m. (6,560 ft.) 13.4 min.
- Climb to 3,000 m. (9,840 ft.) 25.4 min.
- Service ceiling 3,850 m. (12,600 ft.).
- Absolute ceiling 4,450 m. (14,600 ft.).
- Take-off run in 10 km.h. (6 m.p.h.) wind 195 m. (213 yds.).
- Landing run in 10 km.h. (6 m.p.h.) wind 155 mm. (164 yds.).

THE FOKKER S.12 INSTRUCTOR.

The S.12 is identical to the S.11 previously described except that it is fitted with a tricycle landing-gear. In the S.12 the main landing-gear units are moved back a few inches but the basic wing structure is stressed to support the gear in either position. Similarly, the fitting of the nose wheel is provided for in the basic fuselage structure.

THE FOKKER S.14 MACH-TRAINER.

Type.—Two-seat Jet trainer for transition, blind-flying, navigational and tactical training of fighter pilots.

Wings.—Low-wing cantilever monoplane. All-metal monospar structure with flush-riveted stressed Alclad skin. Ailerons on outer sections with spring tabs. Pneumatically-operated split trailing-edge flaps between ailerons and fuselage. Wing area 31.8 m.^{2} (342.1 sq. ft.).

Fuselage.—Circular section structure mainly of light metal construction, the engine compartment being of steel. Pneumatically-operated dive-brakes open out from sides and underside of fuselage aft of wings.

Tail Unit.—Cantilever monoplane type. All-metal construction. Fin integral with

The first production Fokker S.14 Mach Trainer (Rolls-Royce Derwent turbojet engine).

rear fuselage. Statically-balanced light elevators. Statically-balanced geared tabs in both elevators, trim tab in port elevator. Tailplane span 5.00 m. (16 ft. 6.4 in.).

Landing Gear.—Retractable tricycle type. Pneumatic retraction. Main and nose wheel units of levered-suspension type with Dowty liquid-spring shock-absorbers. Pneumatically-operated disc brakes on main wheels. Self-centering nose-wheel. Track 4.95 m. (16 ft. 3 in.). Wheelbase 4.00 m. (13 ft. 3 in.).

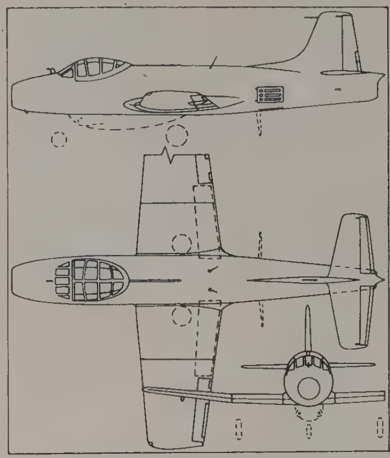
Power Plant.—One Rolls-Royce Derwent 8 or Nene 3 centrifugal-flow turbojet engine in centre-section of fuselage with nose air entry, dividing to pass on each side of cockpit, and tail jet exit. Six flexible light-weight hycatrol fuel tanks in wings, two in centre-section and two in each outer section. Total fuel capacity 1,700 litres (375 Imp. gallons).

Accommodation.—Enclosed cockpit seating instructor and pupil side-by-side with dual controls. Electrically-operated sliding and jettisonable canopy. Cockpit separated from engine compartment by steel fire-proof bulkhead.

Equipment.—Complete blind-flying and navigational training equipment. Provision for armament-pack installation beneath fuselage of two 20 mm. cannon and ammunition. Camera-gun. Racks for eight 3 in. rockets or eight 25-lb. practice bombs.

Dimensions.—
Span 12 m. (39 ft. 5 in.).
Length 13.3 m. (43 ft. 8 in.).
Height 4.7 m. (15 ft. 4 in.).

Weights and Loading (Rolls-Royce Derwent 8 engine).—
Weight empty 3,765 kg. (8,304 lb.).
Crew (2) and parachutes 214 kg. (472 lb.).



The Fokker S.14 Mach-Trainer.

Fuel and oil 1,371 kg. (3,024 lb.).
Take-off weight 5,350 kg. (11,800 lb.).
Wing loading 168 kg./m.^{2} (34.5 lb./sq. ft.).

Weights and Loading (Rolls-Royce Nene 3 engine).—
Weight empty 3,970 kg. (8,745 lb.).
Crew (2) and parachutes 214 kg. (472 lb.).
Fuel and oil 1,366 kg. (3,013 lb.).
Weight loaded 5,550 kg. (12,230 lb.).
Wing loading 174.5 kg./m.^{2} (36 lb./sq. ft.).

Performance (Rolls-Royce Derwent 8 engine).—
Max. speed at 6,000 m. (19,680 ft.) at combat rating 730 km.h. (455 m.p.h.).
Mean cruising speed at 9,000 m. (29,520 ft.) 570 km.h. (355 m.p.h.).
Min. speed at S/L. (flaps 45°) 142 km.h. 88 m.p.h.).
Max. rate of climb at S/L. 945 m./min. (3,100 ft./min.).
Climb to 3,000 m. (9,840 ft.) 3.5 min.
Climb to 6,000 m. (19,680 ft.) 8.5 min.
Climb to 9,000 m. (29,520 ft.) 19.4 min.
Service ceiling 11,200 m. (36,700 ft.).
Take-off distance to 15 m. (50 ft.) 900 m. (2,950 ft.).
Endurance at 400 km.h. (249 m.p.h.) at 9,000 m. (29,520 ft.) 1.45 hours.
Endurance at 480 km.h. (298 m.p.h.) at 9,000 m. (29.520 ft.) 1.70 hours.
Range at 570 km.h. (355 m.p.h.) at 9,000 m. (29,520 ft.) including climb to altitude 965 km. (600 miles).

Performance (Rolls-Royce Nene 3 engine).—
Max. speed at 3,000 m. (9,820 ft.) at combat rating 861 km.h. (536 m.p.h.).
Mean cruising speed at 9,000 m. (19,680 ft.) 781 km.h. (484 m.p.h.).
Min speed at S/L. (flaps 45°) 145 km.h. (90 m.p.h.).
Max. rate of climb at S/L. 1,660 m./min. (5,450 ft./min.).
Climb to 3,000 m. (9,840 ft.) 2.1 min.
Climb to 6,000 m. (19,680 ft.) 4.8 min.
Climb to 9,000 m. (29,520 ft.) 8.8 min.
Climb to 10,500 m. (34,440 ft.) 11.8 min.
Service ceiling 12,900 m. (42,310 ft.).
Take-off distance to 15 m. (50 ft.) 730 m. (2,395 ft.).
Endurance at 560 km.h. (348 m.p.h.) at 9,000 m. (29,520 ft.) 1.50 hours.
Endurance at 480 km.h. (298 m.p.h.) at 9,000 m. (29.520 ft.) 1.70 hours.
Range at 560 km.h. (348 m.p.h.) at 9,000 m. (29,520 ft.) including climb to altitude 910 km. (565 miles).

SOBEH

STICHTING VOOR ONTWIKKELING EN BOUW VAN EXPERIMENTEEL HEFSCHROEFVLIEGTUIG (SOBEH).

Address: Rotterdam v/m Overschie.

This organisation, the literal translation of its name being "Institute for the Development and Construction of an Experimental Helicopter," was formed to develop an experimental rotary-wing aircraft using a rotor system driven by ram-jets. The ram-jets themselves have been developed in conjunction with the National Luchvaart Laboratorium, Amsterdam.

The only details available concerning the SOBEH H-2 helicopter are that the blades of the rotor (9.10 m.=29 ft. 10 in. diameter) are of bonded all-metal construction, the designed all-up weight is 600 kg. (1,320 lb.) and that the estimated maximum speed is 110 km.h. (68 m.p.h.). The prototype, which is illustrated above flew for the first time in May, 1954.

The SOBEH H-2 Experimental Jet-driven Helicopter.

NORWAY

HÖNNINGSTAD

NORSK FLYINDUSTRI A/S. (incorporating Birger Hönningstad A/S.).

Head Office and Works: Post Box 20, Fornebu, near Oslo.

Directors: K. F. Oppegaard (Chairman), Finn Bjerke, Finn Friis, Hans Westfal-Larsen, Birger Hönningstad (Technical Manager), Einar Elvrum (Business Manager).

The original firm Birger Hönningstad A/S. was established in 1936 at Sköyen, near Oslo, by the Norwegian aeronautical engineer Birger Hönningstad and before the war two aircraft had been designed. These were the Norge Model A, which flew in 1938, and the C-5. The prototype of the C-5 was built in the workshops of Wideröe's Flyveselskap.

In 1946 the Hönningstad factory and offices were moved to the Fornebu Airport, Oslo, and in 1947 the name of the company was changed to Norsk Flyindustri A/S. (Norwegian Aircraft Industry, Ltd.).

In 1949 the company completed the Type 5-A Finnmark twin-engined amphibian flying-boat, this craft making its first flight on September 17 of that year. The Type 5-A has been described and illustrated in previous editions of "All the World's Aircraft."

The company also specialises in the design and construction of metal floats, of which a number has been delivered for different types of aircraft.

Since 1952 the company has been manufacturing fuel tanks for jet aircraft under licence from the Fletcher Aviation Corporation, Pasadena, California.

At present Norsk Flyindustri is engaged in the overhaul and repair of jet fighters for the Royal Norwegian Air Force.

THE PHILIPPINE REPUBLIC

INSTITUTE OF SCIENCE AND TECHNOLOGY. (FORMERLY BUREAU OF SCIENCE).

Herran Street, Manila, P.I.

Director: Dr. Joaquin Marañon.

In charge, Aircraft Research and Development: Eng. Antonio J. de Leon.

The Institute of Science and Technology, Manila, is conducting a programme of research and study to investigate the possibilities of aircraft construction in the Philippines. This work is being undertaken under the direction of Engineer Antonio J. de Leon.

As part of this programme the Institute has designed, built and flown the XL-14 Maya experimental monoplane. The main object in building the XL-14 was to test the application of locally available materials, such as home-grown woods, plywood, bamboo, etc., to aircraft construction. One experimental material under test is "Wobex" (Woven Bamboo Experimental) which is a form of re-inforced woven bamboo.

A second aircraft, the XL-15 Tagak Ambulance, which has been developed as a joint project of the Institute of Science and Technology and the Philippine Air Force, has been undergoing flight evaluation tests since October, 1954. The structure of the XL-15 is entirely of local woods, plywood, "Wobex" and allied materials.

Another joint research with the Philippine Air Force which has undergone flight tests is the L-10B Balang, a glider provided with an auxiliary engine for limited sustained flight.

Work is now proceeding on the development of a light two-seat touring and training monoplane, and on an improved version of the XL-15 with higher engine power and increased accommodation.

The XL-14 Maya (100 h.p. Lycoming O-235 engine).

THE XL-14 MAYA.

Type.—Three-seat Experimental monoplane suitable for agricultural uses, general utility duties and observation.

Wings. High-wing strut-braced monoplane. Centre-section integral with fuselage cabin section. Outer wings braced by Vee struts. Structure consists of two parallel solid wood spars, wood ribs, "Wobex" reinforced bamboo mat leading-edge reinforcement and fabric covering. Slotted flaps and ailerons. Gross wing area 16 m.^{2} (172.2 sq. ft.).

Fuselage.—Semi-monocoque structure with wood stringers and "Wobex" (woven bamboo) covering.

Tail Unit.—Strut-braced tailplane with end-plate type fins and rudders. All-wood construction with fabric covering.

Landing Gear.—Fixed tail-wheel type. Two side Vees and two half axles hinged to centre-line of underside of fuselage through rubber - in - compression shock - absorbers. Steerable tail-wheel.

Power Plant.—One 100 h.p. Lycoming O-235-2 four-cylinder horizontally-opposed air-cooled engine. Two-blade fixed-pitch wood airscrew. Fuel capacity 68 litres (15 Imp. gallons).

Accommodation.—Enclosed cabin seating two side-by-side seats in front and one behind. Stick control to left front seat. The rear seat is limited to a 50 kg. (110 lb.) passenger only or baggage of equivalent weight.

Dimensions.—
Span 10.24 m. (33 ft. 6 in.).
Length 6.30 m. (20 ft. 8 in.).
Height (tail up) 2.4 m. (7 ft. 11 in.).
Height (tail down) 2.3 m. (7 ft. 6 in.).

Weights and Loadings.—
Weight empty 510 kg. (1,125 lb.).
Disposable load 270 kg. (595 lb.).
Weight loaded 780 kg. (1,720 lb.).
Wing loading 48.75 kg./m.^{2} (10 lb./sq. ft.).
Power loading 7.8 kg./h.p. (17.2 lb./h.p.).

Performance.—
Max. speed 184 km.h. (115 m.p.h.).
Cruising speed 144-152 km.h. (90-95 m.p.h.).
Landing speed (without flaps) 83 km.h. (52 m.p.h.).
Landing speed (with flaps) 67-72 km.h. (42-45 m.p.h.).
Initial rate of climb 216 m./min. (708 ft./min.).
Service ceiling 3,820 m. (12,500 ft.).
Take-off distance to clear 20 m. (65 ft.) with flaps 350 m. (1,150 ft.).
Range 480 km. (300 miles).

THE XL-15 TAGAK.

Type.—Single-engined General Utility, Liaison or Ambulance aircraft.

Wings.—High-wing semi-cantilever monoplane. Aerofoil sections Mod. NACA 23012 (centre section), USA 35B (outer wings). Aspect ratio 7.1. Dihedral 3°. Incidence at root 2°. Aerodynamic twist —3°. Chord 1.80 m. (5 ft. 11 in.) at root, 1.10 m. (3 ft. 7 in.) at tip. Single lift struts modified to provide additional lift. Split type flaps and slotted ailerons. Total area of flaps 1.46 m.^{2} (15.70 sq. ft.). Total aileron area 1.73 m.^{2} (18.60 sq. ft.). Gross wing area 20.30 m.^{2} (218.43 sq. ft.). Additional area provided by lift struts 0.94 m.^{2} (10.10 sq. ft.)

Fuselage.—Semi-monocoque structure of reinforced wood and plywood and covered with Wobex and plywood. Twin tail booms of all-plywood construction are integral with centre-section.

Tail Unit.—Rectangular tailplane between booms, fins integral with booms. One-piece horn-balanced elevators and two rudders. Tailplane and fins of composite wood and plywood construction with Wobex covering. Elevator and rudders are fabric-covered. Trim-tab in elevator. Areas: fins (2) 1.95 m.^{2} (10.20 sq. ft.), rudders (2) 0.74 m.^{2} (3.23 sq. ft.), tailplane 1.86 m.^{2} (19.70 sq. ft.), elevator (including tab) 1.26 m.^{2} (11.70 sq. ft.).

Landing Gear.—Fixed nose-wheel type. Oleo-spring shock struts for main wheels, oleo-pneumatic strut for nose-wheel. Hydraulic wheel-brakes on main wheels.

Power Plant.—One 185 h.p. Lycoming O-425A six-cylinder horizontally-opposed air-cooled engine. Fixed-pitch two-blade airscrew. Fuel capacity 174 litres (46 U.S. gallons).

Accommodation.—Enclosed cabin seating four in two pairs. For ambulance duties one or two (one above the other) stretcher cases, plus medical attendant, may be carried. Cabin dimensions length 3.26 m. (10 ft. 6 in.), width 0.96 m. (3 ft. 1½ in.).

Dimensions.—
Span 12.00 m. (39 ft. 5 in.).
Length 8.25 m. (27 ft. 2 in.).
Height 2.80 m. (9 ft. 3 in.).

Weights and Loadings.—
Weight empty 780 kg. (1,716 lb.).
Disposable load 470 kg. (1,034 lb.).
Weight loaded 1,250 kg. (2,750 lb.).
Wing loading 61.5 kg./m.^{2} (12.6 lb./sq. ft.).
Power loading 6.58 kg./h.p. (14.51 lb./h.p.).

Performance.—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 158 km.h. (98 m.p.h.).
Landing speed (without flaps) 97 km.h. (60 m.p.h.).
Landing speed (with flaps) 76 km.h. (47 m.p.h.).
Initial rate of climb 180 m./min. (590 ft./min.).
Service ceiling 4,000 m. (13,120 ft.).
Take-off distance to 20 m. (65 ft.) with flaps 360 m. (393 yds.).
Range 675 km. (420 miles).

The XL-15 Tagak (185 h.p. Lycoming O-425A engine).

THE L-10B BALANG.

Type.—Single-seat Glider with auxiliary engine.

Wings.—High-wing rigidly-braced monoplane. G-398 wing section. Aspect ratio 8.1. Chord 1.50 m. (4 ft. 10 in.) constant. Dihedral 2°. Incidence 2°. Two-spar structure of local woods, plywood and "Wobex," covered with fabric. Plain ailerons. Total aileron area 2.72 m.^{2} (29.10 sq. ft.). Gross wing area 17.80 m.^{2} (191.5 sq. ft.).

Fuselage.—Forward fuselage encloses pilot compartment. Rear fuselage is an open truss structure of local woods, plywood and "Wobex," the forward fuselage being covered with fabric.

Tail Unit.—Braced monoplane type. Similar structure to wings. Areas: fin 0.63 m.^{2} (6.75 sq. ft.), rudder 0.75 m.^{2} (8.06 sq. ft.), tailplane 1.47 m.^{2} (15.72 sq. ft.), elevators 0.88 m.^{2} (9.46 sq. ft.). Span of tail 2.95 m. (9 ft. 8½ in.).

Landing Gear.—Nose and main wheels in tandem. Low-pressure tyres provide only springing.

Power Plant.—One 20 h.p. Richter O-45-1 flat-twin air-cooled engine mounted on wing rear spar and driving a small two-blade pusher propeller. Fuel capacity 2.5 U.S. gallons.

Accommodation.—Open pilot's cockpit in forward fuselage.

Dimensions.—
Span 12.0 m. (39 ft. 5 in.).
Length 6.30 m. (20 ft. 8½ in.).
Height 2.50 m. (8 ft. 2½ in.).

Weights.—
Weight empty 150 kg. (330 lb.).
Weight loaded 250 kg. (550 lb.).

Performance.—
No data.

POLAND

The Aircraft Industry of Poland is nationalised and conforms to the following organization.

The industry as a whole is incorporated in the **Zjednoczenie Przemyslu Lotniczego (Z.P.L.)**, or United Aircraft Industry, which comes under the jurisdiction of the Central Council for Armament Industries in the Ministry of Industry.

Z.P.L. has two sub-divisions, one responsible for the design and manufacture of prototypes and the other for series production.

The design and assembly of prototypes is the responsibility of the **Centralne Studium** organization, which is divided into the following three groups :—

Centralne Studium Samolotów which specialises in aircraft development.

Centralne Studium Silników which is concerned with engine research and development.

Centralne Studium Przyrzadów which is responsible for the development and testing of aircraft, engine and navigational instruments.

Series manufacture of aircraft, engines and instruments and equipment is handled by the three following manufacturing groups :—

Państwowe Zaklady Lotnicze (P.Z.L.), or State Aircraft Works, with factories at Mielec, Rzesów and Wroclaw (Breslau).

Państwowa Wytwórnia Czesci Lotniczych (P.W.C.L.), or State Aircraft Parts Plant, with works at Lódz, Kamienna Góra and Lubawka.

Państwowa Fabryka Sprawdzianów Pryzrzadów Lotniczych, or State Aircraft and Navigational Instrument Works, with factories at Jelonia Góra.

The design and development of aircraft prototypes, the ultimate production of which is the responsibility of the P.Z.L. (see above), is undertaken by the **Lotnicze Warsztaty Doswiadczaine** (L.W.D.), or Aircraft Experimental Workshops at Lódź, which comes under the control of the Ministry of Communications.

The **Glowny Instytut Lotnictwa** (Chief Aviation Institute) in Warsaw is a research and testing establishment which is organized on the lines of the Russian Ts.A.G.I.

Finally, the **Szybowniczy Zaklad Doswiadczalny (S.Z.D.)**, or Experimental Gliding Establishment, at Bielsko, designs and builds gliders and sailplanes.

The L.W.D. designed the Szpak and Zak series described in previous editions of "All the World's Aircraft," and the Junak and Zuch trainers.

The Centralne Studium Samolotow (C.S.S.) has produced the C.S.S.10 and 11, both described in previous editions, and the C.S.S.13, which is the Russian PO-2 built under licence.

The principal types of Polish-built aircraft in service with the aeroclubs are the Zak-3, Zuch-2 and C.S.S.13, the last-mentioned being used for glider-towing as well as for training. The Russian-built YaK-18, and the ex-U.S.A.F. Piper Cub are also widely used, as is the Czechoslovak Zlin 26.

THE SZPAK-4T.

The Szpak-4T is a four-seat touring version of the 4A trainer. It has been produced in series to the order of the Ministry of Communications.

Type.—Four-seat Tourer.

Wings. — Low-wing monoplane. Wings braced to upper fuselage longerons by parallel steel tube struts. All-wood structure. Gross wing area 17.6 m.² (189.5 sq. ft.).

Fuselage.—Rectangular wood structure.

Tail Unit.—Cantilever monoplane type.

Landing Gear.—Fixed type. Each main wheel carried by a deformable pyramid, the telescopic sprung leg being anchored to the front wing spar and the two bracing members to the lower fuselage longerons at the wing spar attachment points. Wheel brakes. Main wheel track 2.5 m. (8ft. 2 in.).

Power Plant.—One 150 h.p. Bramo Sh.14 radial air-cooled engine.

Accommodation.—Enclosed cabin seating four in two pairs.

Dimensions.—
Span 11.3 m. (37 ft.).
Length 8.6 m. (28 ft. 2 in.).
Height 2.3 m. (7 ft. 8 in.).

Weights.—
Weight empty 650 kg. (1,433 lb.).
Weight loaded 1,200 kg. (2,645 lb.).

Performance.—
Max. speed 195 km.h. (121 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Min. speed 65 km.h. (40.3 m.p.h.).
Initial rate of climb 2.3 m./sec. (450 ft./min.).
Service ceiling 3,300 m. (10,825 ft.).
Range 700 km. (435 miles).

THE ZAK-3.

Type.—Two-seat Trainer.

Wings.—Low-wing cantilever monoplane. All-wood structure with plywood and fabric covering. One main spar and one diagonal auxiliary centre-section spar. Inset ailerons. Gross wing area 17 m.² (183 sq. ft.).

Fuselage.—Welded steel tube structure covered with fabric.

Landing Gear.—Fixed type. Each main wheel sprung by an oleo shock-strut the upper end of which is attached to lower fuselage longeron at the wing spar attachment and the lower end hinged by Vee struts to the centre-line of the underside of the fuselage. Wheels have brakes and low-pressure tyres. Main wheel track 2.5 m. (8 ft. 2 in.).

Power Plant.—One 65 h.p. Walter Mikron I four-cylinder inverted in-line air-cooled engine.

Accommodation.—Enclosed cockpit seating two side-by-side. Full dual controls. Adjustable seats.

Dimensions.—
Span 11.8 m. (38 ft. 8½ in.).
Length 7.6 m. (23 ft. 11 in.).
Height (tail down) 1.95 m. (6 ft. 5 in.).

Weights and Loadings.—
Weight empty 400 kg. (880 lb.).
Weight loaded 620 kg. (1,365 lb.).
Wing loading 36 kg./m.² (7.38 lb./sq. ft.).
Power loading 9.54 kg./h.p. (21 lb./h.p.).

Performance.—
Max. speed 160 km.h. (100 m.p.h.).
Cruising speed 130 km.h. (81 m.p.h.).
Min. speed 62 km.h. (38.5 m.p.h.).
Initial rate of climb 2.7 m./sec. (520 m./min.).
Service ceiling 3,500 m. (11,480 ft.).
Range 400 km. (248 miles).

THE SZD-8 JASKOLKA (SWALLOW).

Type.—Single-seat high-performance Sailplane.

Wings.—Shoulder-wing cantilever monoplane. Aspect ratio 18.8. Two-spar wood monocoque structure with plywood skin. Each wing has only 14 ribs and forms a torsion box closed by rear spar. Spoilers similar to those on the Jezyk (Grunau Baby) are fitted on upper and lower surfaces. Fabric-covered slotted flaps and ailerons hinged to rear spar. Wing filets. All plywood joints covered with fabric tape. Gross wing area 13.6 m.² (146.4 sq. ft.).

Fuselage.—All-wood monocoque structure of similar construction to wing.

Tail Unit.—Cantilever monoplane type. Fixed surfaces plywood-covered, movable surfaces covered with fabric. Tailplane folds for storage. Version with butterfly tail projected.

Landing Gear.—Ventral skid and single wheel in underside of fuselage.

Accommodation.—Cockpit enclosed by bubble-type transparent hood which slides back for entrance and exit. Full instrumentation and oxygen equipment. Special lever enables pilot to change position in cockpit without undoing safety-belt. Adjustable rudder pedals. Control-locking lever. Trimming knob on end of control column. Baggage compartments in wing roots.

Dimensions.—
Span 16.0 m. (52 ft. 6 in.).
Length 6.14 m. (20 ft. 2 in.).

Weight and Loading.—
Weight loaded 340 kg. (750 lb.).
Wing loading 25 kg./m.² (5.125 lb./sq. ft.).

Performance.—
Diving speed 250 km.h. (155 m.p.h.).
Fineness ratio 28 at 82 km.h. (51 m.p.h.).
Min. speed with flaps 45 km.h. (27.9 m.p.h.).
Min. sinking speed 0.74 m./sec. (2.4 ft./sec.) at 65 km.h. (40.4 m.p.h.).

THE SZD-9 BOCIAN (STORK).

Type.—Two-seat Sailplane for performance flights and intermediate training.

Wings.—High-wing cantilever monoplane with sweep forward. Structure similar to that of SZD-8. Aspect ratio 16.2. Gross wing area 20 m.² (215 sq. ft.).

Tail Unit.—Cantilever monoplane type with folding tailplane similar to that of SZD-8.

Accommodation.—Cockpit with transparent covering seats two in tandem with dual controls. Instrument panel for front seat only but visible from rear seat owing to semi-recumbent position of front occupant.

Dimensions.—
Span 18.0 m. (59 ft.).

Weight and Loading.—
Weight loaded 450 kg. (990 lb.).
Wing loading 22.5 kg./m.² (4.61 lb./sq. ft.).

Performance.—
Max. diving speed 220 km.h. (137 m.p.h.).
Min. sinking speed (crew of two) 0.75 m./sec. (2.46 ft./sec.) at 65 km.h. (40 m.p.h.).
Min. sinking speed (crew of one) 0.65 m./sec. (2.13 ft./sec.) at 65 km.h. (40 m.p.h.).
Fineness ratio 22-26 at 75 km.h. (46.6 m.p.h.).

THE SZD-10 CZAPLA (HERON).

Type.—Two-seat training Glider.

Wings.—High-wing strut-braced monoplane. All-wood structure.

Fuselage.—Polygonal-section wood structure.

Tail Unit.—Cantilever monoplane type with single fin and balanced rudder.

Landing Gear.—Ventral skid and single wheel under fuselage.

Accommodation.—Seating for two in tandem under glazed canopy which hinges to starboard for entry and exit. Full dual controls. Adjustable seats.

Dimensions, Weight and Performance.—No data available.

THE SZD-12 MUCHA 100 (FLY).

The SZD-12 is a single-seat intermediate sailplane. It is a high-wing monoplane, the wing being a single spar structure with an aspect ratio of 15, and is fitted with dive-brakes and spoilers. The fuselage is of elliptical cross section.

Dimensions (Approx.).—
Span 15 m. (49 ft. 3 in.).
Length 7 m. (22 ft. 11 in.).
Height 1.36 m. (4 ft. 2 in.).

Weight and Loadings (Approx.).—
Loaded 210 kg. (462 lb.).
Wing loading 14 kg./m.² (2.86 lb./sq. ft.).

Performance.—
Max. diving speed 250 km.h. (155 m.p.h.).
Min. sinking speed 0.62 m./sec. (1.98 ft./sec.).

PORTUGAL

GOVERNMENT WORKSHOPS

OFICINAS GERAIS DE MATERIAL AERONAUTICO (GENERAL AERONAUTICAL MATERIAL WORKSHOPS).

Alverca do Ribatejo.

Director: Colonel Engineer Bernardo Tiago Mira Delgado.

Sub-Director: Major Engineer Fernando Alberto de Oliveira.

This factory, a department of the Portuguese Air Force, performs all repair and overhaul work for the Air Force as well as for civil aviation.

Aircraft and engines of various types have been built under licence. At present the de Havilland Chipmunk is in production.

Steel structures and ground equipment are also currently manufactured.

RUMANIA

Before the war the principal aircraft and aero-engine manufacturing organization in Rumania was the Regia Autonoma Industria Aeronautica Romana, a state establishment controlled by the Ministries of War and Marine. Apart from building aircraft of its own design under the initials I.A.R. for the Rumanian Air Force, it also manufactured Gnôme-Rhône engines under licence. It had previously built Morane-Saulnier, Potez, Fleet (U.S.A.) and PZL (Polish) aircraft under licence.

After the war the I.A.R. factory at Brasov was de-militarised by the Soviet occupation authorities and later a Soviet-Rumanian commercial agreement provided for the conversion of the establishment into a general engineering undertaking under joint Soviet-Rumanian ownership under the name Sovromtractor. Its principal production is, as its name implies, tractors and agricultural machinery.

The Project Engineering Division of Sovromtractor was, however, responsible in 1948-49 for the design and manufacture of a prototype light aeroplane, the I.A.R. 811. This was the first, and is still apparently the only, aircraft to be produced in Rumania since the end of the war. The prototype, which was fitted with a 60 h.p. Train engine, a French power-unit which is no longer in production, flew for the first time in May, 1949.

Rumania at present relies on other "Iron Curtain" countries to supply its aircraft needs. Civil types in use include the Z-381, the Z-2 (Czechbuilt Storch) and Aero 45 from Czechoslovakia and the PO-2 from Russia. The principal sailplanes in use are the Czechbuilt Sohaj and Lunak.

SOVIET UNION

(Union of Soviet Socialist Republics)

Aircraft production in the U.S.S.R. is controlled at the highest level by the Ministry of the Aviation Industry (MAP), which co-ordinates the output of about 360 factories manufacturing aircraft and components. Of these, some 85 produce airframes, and 30 make aero-engines.

The plants in the U.S.S.R. are distributed all the way from the Polish border to the Maritime Territory, with important concentrations in the Urals and the Kuzbas. The latter groups were mainly developed during the 1941-45 war, when many factories were re-erected far to the east of the fighting zones. Some of these regions also possess iron and coal deposits, and provide important industrial backgrounds for the aircraft industry.

Research and development are carried out by many service and civilian establishments, chief among which are the TsAGI (Central Aero-Hydrodynamical Institute); the TsIAM (Central Institute for Aero-Engines) and the VIAM (Committee for Aircraft Materials); and design bureaux such as those headed by a relatively small number of well-known public figures, as Mikoyan, Yakovlev, and others. There are also institutions like the TsKB (Central Design Office), which is probably a sub-section of the TsAGI.

Much aerodynamic research information was obtained from Germany in 1945; results were eagerly seized upon and many early post-war Soviet jet aeroplanes showed German influence. At first, German B.M.W. and Jumo power-plants were used, but the situation was transformed overnight when the Russians purchased 55 Rolls-Royce Nene and Derwent gas turbines in 1946-47. A series of test-bed aeroplanes were used to evaluate the British engines, which were soon placed successfully in production.

The first worth-while offspring of this period were the MIG-15 fighter and the IL-28 bomber, which were built in large numbers from about mid-1949. Since then they have entered service on a large scale. The former proved itself in battle and has now been superseded by advanced developments.

For a while, heavy reliance was placed on German ideas. The DFS 8-346 project was completed and tested as long ago as 1949. The Junkers EF 150, designed and built under Dr. Ing. Baade, caught the imagination of the Soviets and though there is no evidence that it has entered series production it may have influenced the design of the "Type 39" bomber which appeared in 1954. The Messerschmitt 163 and 263 were apparently the bases of a target-defence intercepter and many German rocket weapons, especially, it is alleged, the A-4, Wasserfall, and the R-4/M, have been studied and built in the U.S.S.R.

Some notes on German-inspired work appeared on pages 188-189 of the 1954 Edition of this Annual.

The advent of the MIG-15 placed the Military Aviation Forces of the U.S.S.R. on a firm footing for the jet age, and with it, true modernisation began.

Similarly, the small aircraft industries in the satellite states shared in the new situation. Where they had previously been limited to completing German contracts and the overhaul and repair of standard Russian types, some now participated in jet production. The MIG-15 has certainly been built in East Germany and in Czechoslovakia and reports from Poland in 1955 spoke of a Polish-built jet fighter and designs for a Polish jet transport.

Russian jet fighters and bombers eventually appeared in the satellite air forces, and two-seater U-MIG-15 jet trainers are known to be in service in Poland and Czechoslovakia.

Full of the confidence engendered by the reliability of the MIG-15 and the IL-28, the Soviet aviation industry was simultaneously studying more widespread problems. And soon there appeared successful helicopters and gliders, as well as seaplane prototypes, while transport and liaison aeroplanes were not neglected.

Turboprop engines were developed, and installed in the "Type 31" heavy bomber, and research in all fields continued steadily, but until 1954, production of new types did not appear to be on a very large scale.

However, that year saw the appearance of the "Type 37" four-jet heavy bomber and the "Type 39" medium twin-jet bomber, as well as the MIG-17, a formidable successor to the MIG-15.

Then, in mid-1955, the Soviets briefly unveiled formations of Types 37 and 39, as well as an even more advanced development of the MIG-17, new large twin-rotor helicopters, four-turboprop bombers, and a large formation of twin-jet night fighters.

The performance capabilities of the new aeroplanes are estimated to be commendably high, and the appearance of large numbers of fighter types is evidence that the Soviet aircraft industry can cope more or less adequately with this aspect of the needs of the VVS.

The capacity for production on the large scale of medium and heavy jet bombers may not yet be so great as for fighters; it can, of course, be argued that with the increased destructive powers of contemporary bombs it does not need to be so large. However, the alternate argument still remains, that contemporary defensive weapons score a higher percentage of kills, and so a large bomber force is still needed. Be that as it may, the Type 39 has been shown off publicly in a formation of 54, and though the production figures have probably reached nothing like those for the Boeing B-47, it is felt in the West that Russia will very shortly possess a formidable bomber striking force.

To what extent, however, these new Soviet military aeroplanes are combat-worthy is an unknown quantity, for the Russian method of assessing fitness for production is not certainly known. The immense territories of the U.S.S.R. effectively hide not only the production capacity but also the prototype aircraft and armament testing facilities. If testing has been carried out in parallel with production, then the occurrence of snags similar to those which have beset many Western aeroplanes may well reduce the effectiveness of the warplanes now appearing in quantity. If, on the other hand, relatively large prototype batches have been utilised, the time for recognition and/or elimination of faults will have been reduced in proportion.

It is probable that the air display of July 3, 1955 has done more than any previous one to shatter any remaining complacency in responsible circles in the West. Now that up-to-date designs are available, and production lines have been laid down, Russian air power may well depend for some years on these advanced aircraft which have lately been displayed.

CODE NAMES.

In 1954 the question of designations for unidentified aeroplanes took one of its periodic swings, this time in favour of code-names for Russian types. They were proposed by the U.S. Navy and Air Force to supplement the previous system of U.S.A.F. "Type Numbers."

Russian Aeroplanes are now divided into Bomber, Cargo, Fighter, Helicopter and Miscellaneous categories, the code names being alliterative. Piston-engined aircraft have names of one syllable while turbine-powered aircraft have two-syllable names.

Fighters.

Fin	LA-7.
Fritz	LA-9.
Fang	LA-11.
Frank	YaK-9.
Fargo	MIG-9.
Fagot (Falcon)	MIG-15
Fantail	?

Fighters—*continued.*

Feather	YaK-17.
Fresco	MIG-17
Farmer	?
Flashlight	?

Bombers.

Buick	PE-2.
Bob	IL-4.
Bat	TU-2.
Bull	TU-4.
Bark	IL-2
Beast	IL-10.
Barge	Type 31 Bomber.
Bison	Type 37 Bomber.
Butcher	IL-28.
Badger	Type 39 Bomber.
Bosun	Type 35 (Naval) Bomber.
Bear	Four-turboprop Bomber.

Cargo.

Colt	AN-2.
Coach	IL-12
Crate	IL-14.

Cargo—*continued.*

Clam	IL-18.
Cab	Li-2.
Cart	TU-70.
Crib	YaK-6.
Creek	YaK-12.
Crow	YaK-14.
Cork	YaK-16.

Helicopters.

Hare	'Mil 1951 helicopter.
Hound	'Mil 1953 helicopter.
Horse	Yakovlev 2-rotor helicopter.

Miscellaneous.

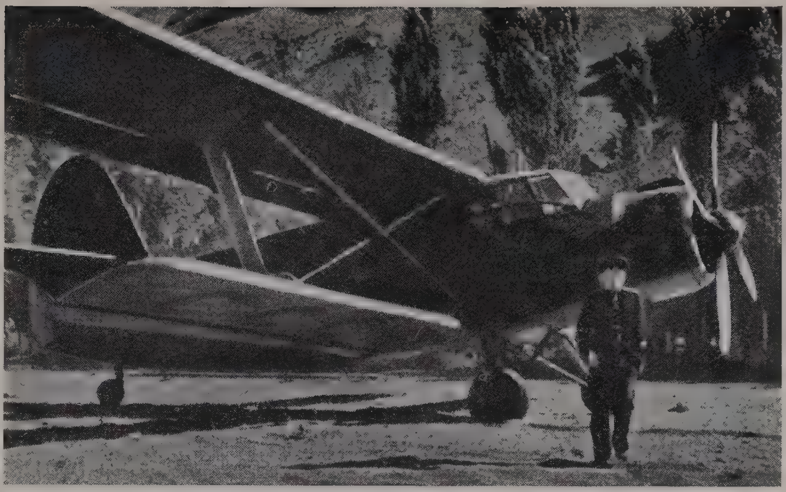
Mule	TO-2.
Mink	UT-2.
Mark	YaK-7.
Moose	YaK-11.
Max	YaK-18.
Magnet	U-YaK-17.
Midget	U-MIG-15.
Mascot	U-IL-28.
Mop	GST (PBY) family.

ANTONOV

OLEG KONSTANTINOVICH ANTONOV.

Antonov, an important glider designer, has a number of his sailplane types, and probably some cargo-gliders, in use in the U.S.S.R. The A-1 is a single-seat elementary training glider; the A-2 is a modernised version of the US-5 two-seat training glider (see the 1951-52 edition); and the A-9 and A-10 are single and two-seat high-performance sailplanes. In 1953 Viktor Il'chenko, in an A-10, made a record "straight-line" flight of 829.82 km, (516 miles).

In early 1952, Antonov and three collaborators were awarded a Stalin Prize of 100,000 roubles for work in the field of aircraft construction in the "transport and commercial" section. This may have been a reward for the success of the AN-2, described hereafter.



The Antonov AN-2 Civil Biplane (ASh-21 engine).

THE AN-2.

U.S. Code Name: "Colt."

The AN-2 is a large passenger-carrying biplane which was first known to be in service in 1950. It is capable of operating from small airfields and has taken over a number of duties previously performed by the PO-2, notably the training of parachutists, communications duties and forestry patrol.

TYPE.—Single-engined Passenger Biplane.

WINGS.—Single-bay unequal-span biplane. I-type interplane struts. Ailerons and flaps in upper and lower wings.

FUSELAGE.—Circular section all-metal structure.

TAIL UNIT.—Monoplane type with small bracing struts below tailplane.

LANDING GEAR.—Fixed tail-wheel type. Can also operate on skis and some have been modified to be fitted with floats.

POWER PLANT.—One ASh-21 seven-cylinder radial air-cooled engine. Four-blade airscrew.

ACCOMMODATION.—Crew's cabin well glazed, with overhang for downward vision, mounted forward of top wing. Passenger cabin (accommodation unknown) with baggage compartment aft.

EQUIPMENT.—Includes radar aids for landing.

DIMENSIONS (Approx.).—
Span (upper) 14.2 m. (46 ft. 8 in.).
Span (lower) 10.65 m. (35 ft.).
Length 11.36 m. (37 ft. 2 in.).

WEIGHTS AND PERFORMANCE.—
No data available.

IL'YUSHIN

SERGEI VLADIMIROVICH IL'YUSHIN.

Il'yushin is an active designer of diverse aircraft types. In March, 1952, in collaboration with ten co-workers, he was awarded a Stalin Prize of 150,000 roubles for "new work in aircraft construction." At the time of writing he is represented mainly by the IL-10, IL-12 and IL-28, which are in widespread service, and a swept-wing bomber, probably derived from the IL-28, has also been reported to be in service.

In 1954 there appeared the IL-14, a modified version of the IL-12 for military transport and/or V.I.P. use.

The first announcement in 1955 of a Russian civil jet transport credited Il'yushin with the design of the IL-20.

The IL-28 Attack Bomber.

THE IL-28.

U.S. Code Name: "Butcher."

The IL-28 appeared in numbers over Moscow on May Day, 1950, and several versions are now in service with Soviet Air Force units in all parts of the U.S.S.R. and the satellites.

TYPE.—Twin-jet Attack Bomber.

WINGS.—Shoulder-wing cantilever monoplane with straight leading-edge and swept-forward trailing-edge.

FUSELAGE.—Circular-section all-metal structure.

TAIL UNIT.—Swept-back surfaces, tailplane dihedral.

LANDING GEAR.—Main wheels retract forward and lie flat in nacelles. Double nose-wheel.

POWER PLANT.—Two RD-45 centrifugal-flow turbojet engines.

ACCOMMODATION.—Raised pilot's cockpit, glazed nose position with optically flat panel. Tail gunner's position under rudder.

ARMAMENT AND EQUIPMENT.—Two heavy guns in lower part of nose, two tail guns.

DIMENSIONS (Approx.).—
Span 22 m. (72 ft. 2 in.).
Length 20 m. (65.5 ft.).

PERFORMANCE.—
Max. speed about 975 km./hr. (605 m.p.h.)

The Il'yushin U-IL-28 Trainer.

THE U-IL-28 TRAINER.

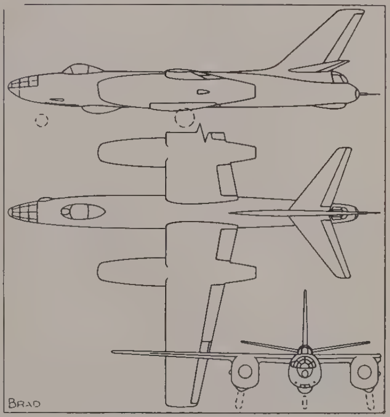
U.S. Code Name: "Mascot."

In 1951 there appeared a trainer version of the IL-28 bomber. This differs from the operational version in having a stepped-down tandem cockpit arrangement and lacks the radome. Generally it does not carry all the armament of the standard bomber version. Several have been seen in East Germany.

THE IL-20.

In the Spring of 1955, Moscow Radio announced that the IL-20 jet transport had been introduced on the domestic airlines for carrying important material, *i.e.* newspapers, over long distances.

Preliminary reports indicate that the IL-20 is a swept-wing monoplane similar in general configuration to the D.H. Comet, but there seems to be some confusion over the number of engines fitted (different sources have powered the aircraft with both two and four turbojets).



The Il'yushin IL-28.

The IL-20 appeared at the Aviation Day Display on July 3, 1955. It flew over Tushino at great height so that few details were visible.

THE IL-14.

U.S. Code Name: "Crate."

The IL-14 differs externally from the IL-12 mainly in having a revised tail configuration, blunter wing-tips and some thrust augmentation similar to that employed in the Convair-Liner. There is believed to be accommodation for a crew of five and 18-21 passengers.

The dimensions are said to be approximately the same as those of the IL-12. No other details are available, but a photograph appears on the next page.

The Il'yushin IL-14 Airliner (two 1,775 h.p. ASh-82FNV engines). (*Flight photograph*).

THE IL-12.

U.S. Code Name: "Coach."

The IL-12, which first flew in 1946, is still the standard medium-range airliner used by Aeroflot. The IL-12 is also in service with C.S.A. (Czechoslovak Airlines) and L.O.T. (Polish Airlines).

Type.—Twin-engined Transport monoplane.

Wings.—Low-wing cantilever monoplane. Two spar metal structure, with metal stressed skin covering. Ailerons in outer panels, with trim tab in starboard aileron only. Split trailing-edge flaps, divided into two at junction of outer panels and centre section. Wing de-icing by warm air ducted through oil coolers and thence to leading-edges.

Fuselage.—Oval all-metal semi-monocoque structure.

Tail Unit.—Cantilever monoplane type with single fin and rudder. May be seen with or without dorsal fin extension. Metal-clad fixed surfaces, control surfaces metal-framed, fabric-covered. Spring tab in rudder and elevators. Tailplane de-icing as for wings.

Landing Gear.—Retractable tricycle type. Single nose-wheel retracts rearwards into fuselage. Main wheel units, each with twin wheels, retract forward into engine nacelles. Detachable tail strut used during loading operations.

Power Plant.—Two ASh-82FNV fourteen-cylinder two-row radial air-cooled engines developing 1,775 h.p. for take-off at 2,400 r.p.m. Rated power 1,600 h.p. at 2,050 m. (6,730 ft.) and 1,350 h.p. at 5,540 m. (17,720 ft.). Four-blade metal constant-speed fully-feathering airscrews. Total fuel capacity 6,500 litres (1,435 Imp. gallons) in eight tanks, two in fuselage, two in centre section, two in each outer wing section.

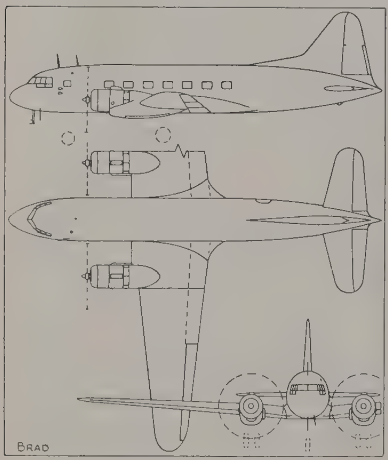
Accommodation.—Crew of five, comprising pilot and co-pilot side-by-side, navigator and radio-operator on flight deck to rear of pilots, and stewardess. Accommodation for 27-32 passengers in air-conditioned main cabin. Standard version seats 27 in a row of nine single seats down the starboard side of cabin, and nine double seats down port side. Toilet compartment at rear.

Equipment.—Night and blind-flying equipment, two-way V.H.F. and full radio installations.

Dimensions.—
- Span 31.7 m. (104 ft.).
- Length 21.31 m. (69 ft. 10¾ in.).
- Height 8.07 m. (26 ft. 6 in.).

Weights and Loadings (27-passenger version).—
- Empty weight 9,000 kg. (19,850 lb.).
- Payload 3,000 kg. (6,610 lb.).
- Loaded weight 17,250 kg. (38,000 lb.).
- Take-off power loading 4.76 kg./c.v. (10.7 lb./h.p.).

Performance.—
- Max. speeds 365 km.h. (226 m.p.h.) at sea level.
- 370 km.h. (230 m.p.h.) at 500 m. (1,640 ft.).
- 385 km.h. (239 m.p.h.) at 1,000 m. (3,280 ft.).
- 407 km.h. (252 m.p.h.) at 2,500 m. (8,220 ft.).
- Cruising speeds 325 km.h. (202 m.p.h.) at sea level.
- 335 km.h. (208 m.p.h.) at 1,000 m. (3,280 ft.).
- 350 km.h. (217 m.p.h.) at 2,500 m. (8,220 ft.).
- 345 km.h. (214 m.p.h.) at 3,000 m. (9,840 ft.).
- Landing speed 145 km.h. (90 m.p.h.).
- Take-off run 360 m.-520 m. (1,185 ft.-1,705 ft.).
- Landing run 450 m. (1,475 ft.).
- Single-engine ceiling 3,000 m. (9,840 ft.).
- Range with 32 passengers 20 kg. (45 lb.) baggage each 1,250 km. (777 miles).



The Il'yushin IL-12 Airliner.

The Il'yushin IL-10 Shturmovik Close-Support Monoplane.

The Il'yushin IL-12 Airliner (two 1,775 h.p. ASh-82FNV engines). (*F. G. Swanborough*).

Range with 27 passengers 20 kg. (45 lb.) baggage each 2,000 km. (1,240 miles).
Range with 16 passengers (de luxe version) 3,000 km. (1,865 miles).

THE IL-10 SHTURMOVIK.

U.S. Code Name : "Beast."

TYPE.—Two-seat Close-Support and Reconnaissance monoplane.

WINGS.—Low-wing cantilever monoplane. Metal structure and covering. Split flaps. Balanced two-piece ailerons with trim tabs.

FUSELAGE.—Oval section of all-metal construction and metal covering.

TAIL UNIT.—Cantilever monoplane type. Single fin and horn-balanced rudder. Fixed surfaces metal structure metal covered. Control surfaces metal structure, fabric covering.

LANDING GEAR.—Tail-wheel type, main wheels retract hydraulically backwards, the oleo legs turning through 90° for the wheels to lie flush in the wings. Tail-wheel is semi-retractable.

POWER PLANT.—One 2,000 h.p. AM-42 twelve-cylinder Vee liquid-cooled engine driving a three-bladed constant-speed airscrew. Armour plate on underside of engine.

ACCOMMODATION.—Pilot's cockpit with raised canopy above wing and enclosed gunner's position for rear defence. Extensive armour plate in cockpit and at rear bulkhead of gunner's compartment.

ARMAMENT AND EQUIPMENT.—Two 23 mm. cannon and two 7.62 mm. machine-guns in the leading-edge of the wings. Armament may be varied for different missions. One hand-operated 12.7 mm. machine-gun in rear position. Four rocket-projectile guide-rails beneath each wing. Centre-section has internal stowage for two 500 kg. (1,100 lb.) bombs.

DIMENSIONS.—
Span 13.7 m. (44 ft. 11 in.).
Length 11.95 m. (39 ft. 3 in.).

WEIGHTS AND LOADINGS.—
No data available.

PERFORMANCE.—
Max. speed 450 km.h. (280 m.p.h.) at 2,130 m. (7,000 ft.).

KAMOV

N. I. KAMOV.

The Kamov K-17 helicopter, popularly called the "Vertolet" in the U.S.S.R., was briefly described in the 1951-1952 edition of this Annual. Since then the type has been built in some numbers, apparently for military usage.

In 1954 a later modification was shown. This differs from the earlier type in having twin vertical tail surfaces, as shown in the accompanying photograph. Technical details are not available.

The 1954 Kamov Single-seat Helicopter.

MIG.

ARTEM MIKOYAN AND MIKHAIL GUREVICH.

Mikoyan, brother of the Minister for Foreign Trade, and Gurevich, a mathematician, have collaborated for many years in the design of high-performance fighter aircraft. They were responsible for the MIG-9 of 1946, one of the first all-Russian jet fighters to go into service in Soviet squadrons. The MIG-9 is now obsolete.

The modern trend of Russian fighter design is typified by the MIG-15, which proved itself in action in Korea to be one of the World's best jet fighters. The Russians were assisted considerably in its design by German plans and technicians. It shows some similarity to drawings of the Ta 183 but has also been stated to be the brain child of Siegfried Günther. Whoever was responsible, it must be conceded that the design, construction and production of such an advanced type as the MIG-15 was a remarkable achievement. It must also be borne in mind that it was necessary to make a technical analysis and breakdown of the many components and materials of the Rolls-Royce Nene engine, and to re-design and produce it as the power-plant of the MIG-15.

The production MIG-15 began to appear in squadron service in numbers in 1949, and by 1952 it was flying in many satellite air forces. Many hundreds—probably some thousands—of the MIG 15's have been made available for their use.

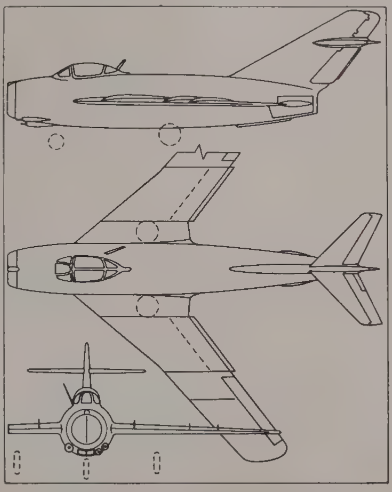
The MIG-17, a progressive development of the MIG-15, appeared in Soviet squadrons in 1953 or 1954.

THE MIG-17.

U.S. Code Name: "Fresco."

The MIG-17 differs from the MIG-15 in a number of external points. The fuselage seems to be rather slimmer and the wings have a greater sweepback, which is now about 40-45 degrees. The wing plan form has been altered, as there is a break in the leading-edge, a small centre-section and the tips are now rounded.

The dive brakes are longer than those on the MIG-15 and bear a small bulge. A small "keel" or fairing is present beneath the rear fuselage, and the cockpit hood is slightly higher than that of the MIG-15.



The MIG-17 Single-seat Fighter.

The engine is probably an improvement of the VK-1 ; there is provision for after-burning.

The MIG-17 possesses more comprehensive radar than the MIG-15, and this includes an IFF installation.

Maximum speed is thought to be in the region of 1,200 km.h. (745 m.p.h.) and dimensions are roughly the same as those of the MIG-15.

THE MIG-15.

U.S. Code Name: "Fagot."

TYPE.—Single-seat Jet Fighter.

WINGS.—Mid-wing cantilever monoplane. Sweepback at leading-edge 42°. Dihedral -3°. Thickness/chord ratio 11 per cent constant. All-metal light alloy stressed-skin structure with two main I-section spars. The straight rear spar, which takes all main wing loads, is attached to a heavy steel and aluminium fuselage frame. The front spar is cranked forward from the landing-gear attachment point to serve as front wall of wheel-well, and is attached to another strong fuselage frame. A third short spar member, originating just outboard of the landing-gear hinge point, runs at right angles to the fuselage centre-line and transmits wing bending loads. Hydraulically-operated Fowler split flaps. Ailerons have both mass and sealed aerodynamic balances.

A formation of MIG-17 Single-seat Swept-wing Fighters.

The MIG-15 Single-seat Swept-wing Fighter (RD-45 turbojet engine).

Two stall fences on each wing. Gross wing area 23.7 m.² (255 sq. ft.).

FUSELAGE.—Semi-monocoque light alloy stressed-skin structure. In two main units, a forward assembly of nose and mid sections, and a rear section, joined by quick-release bolts at the rear wing spar attachment points; the rear fuselage being easily detachable for engine servicing. Air brakes on rear fuselage.

TAIL UNIT.—Cantilever monoplane type. Sweepback on fin and tailplane leading-edges 42°. Thickness/chord ratio on all surfaces 8 per cent. Tailplane, high up fin, has single steel spar and light alloy frames and skin. The large fin has two spars, the rear spar of steel and the other spar, frames and skin of light alloy. Fin rear spar, which takes main flight loads, attached to heavy steel fuselage frame surrounding jet orifice. Tailplane incidence adjustable on ground only. Elevators and rudders of stressed light alloy construction. Electrically-operated trim-tab in port elevator. Both upper and lower rudders mass-balanced. Tailplane span 4.5 m. (14 ft. 10 in.).

LANDING GEAR.—Retractable tricycle. Air-oil shock absorbers. Main wheels, with levered suspension, raised inward, nose wheel forward. Hydraulic retraction, with emergency pneumatic system. Hydraulic wheelbrakes.

POWER PLANT.—One RD-45 centrifugal-flow turbojet engine (2,725 kg.=6,000 lb. s.t.). Bifurcated nose air-inlet. Fuel tanks in mid fuselage section between the divided air intake ducts. Total internal fuel capacity 1,250 litres (330 U.S. gallons). Drop tanks 600 litres (160 U.S. gallons) each may be carried, one under each wing.

ACCOMMODATION.—Pressurised cockpit forward of wing leading-edge with sliding canopy. Max. pressure 4.2 lb./sq. in. from 26,000 ft. (7,930 m.) up. Oxygen system is provided for emergency use. Ejection seat with automatic release, not fitted in early examples, is now standard.

ARMAMENT.—Standard armament consists of two NS (Nudelmann-Suranov) 23 mm. cannon below port side of nose and one 37 mm. N (Nudelmann) cannon below starboard side. Guns mounted in a carriage which can be lowered for easy maintenance when a panel is removed. Gyro gun-sight. Rockets or two 1,000 bombs may be carried under wings. Earlier MIG-15's had two 12.7 mm. machine-guns and one 37 mm. cannon. Other armament combinations have been fitted to some examples, including trials of a 45 mm. cannon and an all machine-gun installation.

DIMENSIONS.—
Span 10.10 m. (33 ft. 1½ in.).
Length 11.10 m. (36 ft. 4 in.).
Height 3.40 m. (11 ft. 2 in.).

WEIGHTS.—
Weight empty 3,780 kg. (8,320 lb.).
Weight loaded (combat) 5,120 kg. (11,270 lb.).
Max. loaded weight (with external fuel or bombs) 6,465 kg. (14,240 lb.).

PERFORMANCE.—
Max. speed approx. 1.072 km.h. (670 m.p.h.).
Stalling speed 175 km.h. (109 m.p.h.).
Initial rate of climb 3,170 m./min. (10,400 ft./min.).
Service ceiling 15,550 m. (51,000 ft.).

THE MIG-15*bis*.

TYPE.—Single-seat Jet Fighter.

CONSTRUCTION.—As for standard MIG-15, but wings of MIG-15*bis* have perforated flaps.

POWER PLANT.—One VK-1 centrifugal-flow turbojet engine (2,700 kg.=5,955 lb. s.t.).

FUEL.—T-77 kerosene. Internal capacity 1,410 litres (310.2 Imp. gallons) external fuel 490 litres (108 Imp. gallons).

ACCOMMODATION.—Pilot's seat below rear-sliding canopy.

ARMAMENT AND EQUIPMENT.—One 37 mm. cannon with 40 rounds on starboard side of lower front fuselage; two 23 mm. NS cannon each with 80 rounds on port side. Gyro gun sight. Attachments for auxiliary fuel tanks.

DIMENSIONS.—
Span 10.1 m. (33 ft. 1½ in.).
Length 11.1 m. (36 ft. 4 in.).
Wing area 17.25 m.² (186.7 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight loaded 5,028 kg. (11,085 lb.).

PERFORMANCE.—
Max. speed between 1,100-1,200 km./hr. (684-746 m./hr.).
Stalling speed (clean) 210 km./hr. (131 m.p.h.).
Stalling speed (flap and L/G down) 190 km./hr. (118 m.p.h.).
Ceiling above 15,000 metres (49,200 ft.).
Endurance about 2 hours.

THE U-MIG-15.

U.S. Code Name: "Midget."

TYPE.—Two-seat conversion trainer developed from MIG-15.

CONSTRUCTION.—Similar to fighter type.

POWER PLANT.—One RD-45 centrifugal-flow turbine developed from Nene.

ACCOMMODATION.—Pupil and instructor sit in tandem under long raised canopy.

ARMAMENT.—Guns not carried but fairings are retained.

DIMENSIONS.—
Span 10.10 m. (33 ft. 1½ in.).
Length 11.10 m. (36 ft. 4 in.).

PERFORMANCE.—
Similar to that of MIG-15.

The U-MIG-15 Two-seat Fighter Trainer (RD-45 turbojet engine).

MIL'

MIKHAIL L. MIL'.

Mikhail Mil' is a well-known worker in the field of rotating-wing aeroplanes. One of the first really successful Soviet helicopters, which should be capable of a wide range of duties, was exhibited at the 1951 Soviet Aviation Day Display at Tushino, and was a Mil' design. Full technical details are not yet available, but the general layout of the helicopter is somewhat similar to that of the Sikorsky S-51. The power-plant is reported to be an M-62IR—a pre-war nine-cylinder air-cooled radial of about 840 h.p. The approximate overall length of the helicopter is 11.6 m. (35 ft.) excluding rotors. This 1951 helicopter was numbered Type 32 in the U.S.A.F. type designation system and has the code name "Hare."

THE MIL' 1953 HELICOPTER.

U.S. Code Name: "Hound."

In 1953 another, and larger, Mil' helicopter appeared at Tushino. Again, no technical details are available but it will be seen from the accompanying illustration that this craft is similar in general conception to the Sikorsky S-55, even to the mounting of the engine in the nose. Access to the main cabin is apparently by "clam-shell" type doors under the tail boom.

This 1953 Mil' helicopter, which is U.S.A.F. Type 36, is said to be capable of carrying a small automobile or two motor-cycle/sidecar combinations. Alternatively, ten troops can be accommodated. The helicopter is normally operated by a crew of two.

The 1953 Mil Helicopter which is generally similar to the Sikorsky S-55.

TUPOLEV

ANDREI NIKOLAEVICH TUPOLEV.

A. N. Tupolev still holds an important place in the Russian aeronautical field. Born in 1888, he is apparently still the active head of an important design establishment; for much of his life he has been connected with the TsAGI and TsKB, and designers such as Sukhoi and Petlyakov have been his pupils and collaborators. In March, 1952, Tupolev and thirteen co-workers were awarded a Stalin Prize of 150,000 roubles for "new work in aircraft construction."

Many examples of the TU-2 and TU-4 bombers are still in service, together with smaller numbers of a long-span reconnaissance version of the former, probably designated TU-6 (see this Annual for 1952).

Post-war jet designs attributed to Tupolev have included a light twin-jet straight-wing bomber of 1948 and a later development bearing the NATO code number "Type 35". The latter is apparently intended for naval use, and the descriptions which follow clarify these two types as far as possible.

Tupolev has also been associated with the development of a new large strategic bomber for the Soviet air forces. The rumours of a swept-wing six-engined design still persist, but production of such a type, if it exists, has not developed as far as that of the TU-4 replacement known provisionally as the TUG-75. This four-turboprop aeroplane is in squadron service.

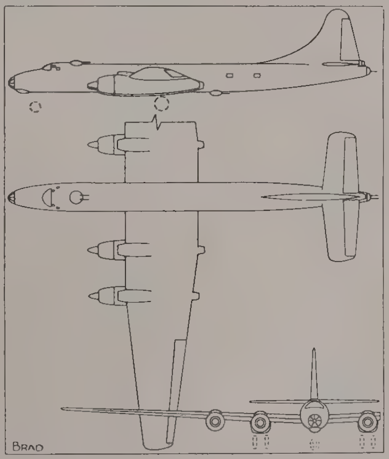
THE TUG-75 (?) (TYPE 31).

U.S. Code Name: "Barge."

This long-range bomber is thought to be the TUG-75. It received the U.S.A.F. Type 31 designation some years ago.

The prototype had four Junkers Jumo compression-ignition engines, and reliable reports say that a long-range reconnaissance version of the prototype powered by four Jumo 224 diesel engines is now in service, in addition to the turboprop powered bomber described below.

TYPE.—Four-engined Long-range Strategic Bomber.
WINGS.—Cantilever monoplane type, derived from that of the TU-4 and, in turn, the Boeing B-29.
FUSELAGE.—Circular section all-metal structure, with crew compartments probably pressurised.
TAIL UNIT.—Of normal design, with large fin fairing.
LANDING GEAR.—Nose-wheel retractable type, with main wheels housed in outer nacelles.
POWER PLANT.—Four Junkers Jumo 022 turboprop engines, each developing 3 000 s.h.p. plus 2,250 lb. (1,020 kg.) residual thrust. Contra-rotating airscrews.
ACCOMMODATION.—Crew positions in nose, amidships and tail.
ARMAMENT AND EQUIPMENT.—Dorsal, ventral and tail gun turrets, and possibly lateral gun positions. Radome forward of nose-wheel.
DIMENSIONS (Approx.).—
Span 56.4 m. (185 ft.).
Length 44.25 m. (145 ft.).
WEIGHTS.—
Loaded weight approx. 95,000 kg. (210,000 lb.).
PERFORMANCE (Approx.).—
Max. speed 670 km.h. (415 m.p.h.) at 9,150 m. (30,000 ft.).
Range 12,360 km. (7,650 miles).



The TUG-75 (?) (Provisional).

TU-? TWIN-JET BOMBER.

This design, which may be the TU-10, appeared in 1948. Two versions were built, one having the tailplane swept-back and the other having a straight tailplane. A small number appears to have entered squadron service.

TYPE.—Twin-jet light Assault Bomber.
WINGS.—Shoulder-wing cantilever monoplane.
FUSELAGE.—Circular-section all-metal structure.
TAIL UNIT.—Tall vertical fin and rudder. Two tailplane designs, swept or straight.
LANDING GEAR.—Retractable nose-wheel type. Main wheels retract into nacelles.
POWER PLANT.—Probably two RD-45 centrifugal-flow turbojet engines.
ACCOMMODATION.—Raised pilot's position. Gunner amidships.
ARMAMENT.—Two nose guns. Guns in dorsal turret and ventral position. Can carry torpedoes (?).
DIMENSIONS (Approx.).—
Span 24.4 m. (80 ft.).
Length 24.4 m. (80 ft.).
WEIGHTS (Approx.).—
Loaded weight 24,000 kg. (52,920 lb.).
PERFORMANCE (Estimated).—
Max. speed 850 km.h. (528 m.p.h.) at 5,500 m. (18,050 ft.).
Range 2,960 km. (1,840 miles).

TU-? (TYPE 35) NAVAL BOMBER.

U.S. Code Name: "Bosun."

The "Type 35" was mentioned in the U.S.A. in 1952 as a new light Russian bomber, with a higher performance than the IL-28. It is reported to have been produced for naval use.

This bomber is closely related to the TU twin-jet bomber of 1948, but has a radome, blunter tail, fin extension, and a sloping trailing-edge to the rudder.

TYPE.—Twin-jet Attack Bomber.
WINGS.—Shoulder-wing all-metal cantilever monoplane.
FUSELAGE.—Circular section all-metal structure.
TAIL UNIT.—Swept-back tailplane. Low aspect-ratio fin and rudder with fin extension.
LANDING GEAR.—Retractable nose-wheel type. Main wheels retract into nacelles.
POWER PLANT.—Two VK-1 centrifugal-flow turbojet engines.
ACCOMMODATION.—Raised cockpit hood. Probably a nose position for bomb-aimer. Existence of tail position uncertain.
ARMAMENT.—Believed two guns under nose. Twin guns in tail.
DIMENSIONS (Approx.).—
Span 25.5 m. (83 ft.).
Length 24.4 m. (80 ft.).
WEIGHTS AND PERFORMANCE.—
No data available.

THE TU-4.

U.S. Code Name: "Bull."

Tupolev was responsible for the analysis and re-design for Russian production of the Boeing B-29 Superfortress, three

The TU-4, the Russian-built B-29 Superfortress Bomber.

specimens of which were forced to land near Vladivostok in 1944, in what was then neutral territory. The crews were interned and the aircraft impounded for Tupolev and his technical comrades to begin their task of reproduction.

The TU-4 is an "oriental" copy of the B-29, and roughly 1,500-2,000 are believed to have been built. It is powered with four ASh-90 copies of the Wright R-3350 engine, which drive Russian-made Hamilton-Standard Hydromatic airscrews. Russian guns, however, have been substituted for the B-29's complex remotely-controlled gunnery system. There is little doubt that Tupolev has skilfully met the performance of the American B-29.

YAKOVLEV

ALEKSANDIR SERGEEVICH YAKOVLEV.

Yakovlev has shown himself, by his products, to be of the same order of versatility as A. N. Tupolev. He has gradually developed his designs from the earliest days, when he produced sailplanes and light sportplanes, through the trainer period and into the times when his famous piston-engined fighters made the largest contribution to Russian fighter strength. Late developments of the YaK-9, notably the YaK-9P, are still in service with the satellite countries. A number of YaK-9P's were encountered in combat over Korea in 1950.

Of the many other important Yakovlev aeroplanes, the YaK-14 has been modified from its original form and began to replace the PO-2 in 1949.

The YaK-11 trainer is in use by the Soviet Air Fleet and by civilian aviation clubs, and has also appeared in Rumania, Hungary and Korea. The F.A.I. has homologated two records for this type. In August, 1950 Ya. D. Forostenko flew a YaK-11 with take-off weight of 2,213 kg. (4,868 lb.) at an average speed of 441 km.h. (273.86 m.p.h.) over 500 km. (310.5 miles), and in September, 1950, Vladimir Markov flew a YaK-11 over 100 km. (62.1 miles) at an average speed of 479 km.h. (297.46 m.p.h.).

THE YaK HELICOPTER.

U.S. Code Name: "Horse."

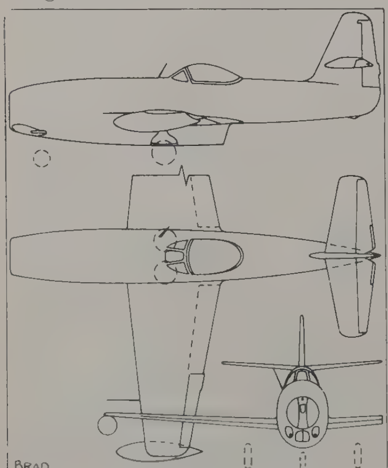
Four examples of a large twin-rotor twin-engined helicopter credited to Yakovlev appeared at Tushino on July 3, 1955. They were of a type not seen before and few technical details are available.

In general configuration the Yakovlev helicopter is similar to the Piasecki H-16 and the Bristol 173 in many ways, having the large raised rear rotor pylon of the Piasecki and the 45° tail surfaces of the Bristol. The long tram-like fuselage is said to have accommodation for approximately 40 fully-armed troops, while military vehicles and other bulky items can be loaded by ramp though a large door at the rear end of the fuselage.

THE YaK-23.

U.S. Code Name: "Flora."

The YaK-23 (described in the 1953-54 edition of "All the World's Aircraft" as an improved YaK-17) is an all-metal higher-powered development of the YaK-17. The squaring-off of the wing and tail surfaces and alterations to the landing gear are among the most noticeable changes.



The YaK-23 Interceptor Fighter.

Type.—Single-seat Interceptor Fighter.
Wings.—Mid-wing cantilever monoplane. All-metal construction. Constant taper with blunt wing-tips.
Fuselage.—All-metal structure.
Tail Unit.—Cantilever monoplane type. Tailplane now has blunted or squared tips.
Landing Gear.—Retractable tricycle type, main wheels raises inwards into wings and nose wheel backwards with fairing under forward part of fuselage.
Power Plant.—One RD-500 (?) centrifugal-flow turbojet engine, believed to be developed from the Rolls-Royce Derwent, in lower extension of forward fuselage with jet pipe exit in line with trailing-edge of wing. May be seen with wing-tip auxiliary fuel tanks.
Accommodation.—Single-cockpit with sliding canopy above wings.
Armament.—Two cannon below nose air-intake.
Dimensions (Approx.).—
Span 10.0 m. (32 ft. 10 in.).
Length 9.0 m. (29 ft. 7 in.).
Weights and Performance.—
No data available.

A trio of YaK-18 Trainers, each powered by a 160 h.p. M-11 engine.

THE YaK-18.

U.S. Code Name: "Max."

Type.—Two-seat Training monoplane.
Wings.—Low-wing cantilever monoplane. Metal structure, leading-edge stiffened with aluminium sheet, and fabric covering. Large ailerons in outer panels; one-piece flap across centre-section at trailing-edge.
Fuselage.—Metal basic structure, with built-up formers and longerons. Metal covering back to rear cockpit, fabric covering on rear section.
Tail Unit.—Braced monoplane type with single fin and rudder. Fabric covering on all surfaces. Trim tab in rudder.
Landing Gear.— Retractable tail-wheel type. Wheels retract hydraulically backwards into wells in wing, about half of wheel remaining exposed. Hydraulic retraction. Fixed castoring tail-wheel.
Power Plant.—One 160 b.h.p. M11-RF five-cylinder air-cooled single-row radial engine in "helmeted" cowl. VISh(a) two-blade variable pitch metal airscrew with large spinner. Diameter 2 m. (6 ft. 6½ in.).
Accommodation.—Two seats in tandem beneath continuous canopy raised above top-line of fuselage.
Equipment.—Includes blind-flying instruments, radio receiver and transmitter.
Dimensions.—
Span 10.6 m. (34 ft. 9 in.).
Length 8.03 m. (26 ft. 4½ in.).
Height 3.15 m. (10 ft. 4 in.)
Wing area 17 m.² (183 sq. ft.).
Weights and Loadings.—
Weight empty 755 kg. (1,665 lb.).
Weight loaded 1,070 kg. (2,360 lb.).
Wing loading 63 kg./m.² (12.9 lb./sq. ft.).
Power loading 6.7 kg./c.v. (14.8 lb./b.h.p.).
Performance.—
Max. speed 257 km.h. (159 m.p.h.).
Cruising speed 215 km.h. (133.5 m.p.h.).
Landing speed 85 km.h. (53 m.p.h.).
Ceiling 5,000 m. (16,400 ft.).
Range 900 km. (560 miles).
Take-off distance 290 m. (950 ft.).
Landing distance 247 m. (810 ft.).

THE U-YaK-17.

U.S. Code Name: "Magnet."

The U-YaK-17 two-seat conversion trainer is a version of the earlier modified YaK-17 with nose-wheel landing-gear and a Russian-built Jumo 004B axial-flow turbojet power-unit. The instructor and pupil are in tandem cockpits beneath a continuous canopy. The armament is probably deleted.

Dimensions (Approx.).—
Span 9.15 m. (30 ft.).
Length 8.54 m. (28 ft.).
Performance.—
Max. speed about 815 km.h. (506 m.p.h.).
Cruising speed 595 km.h. (368 m.p.h.) at 9,150 m. (30,000 ft.).
Climb to 9,150 m. (30,000 ft.) 13.5 min.
Service ceiling 12,200 m. (40,000 ft.).
Range 645 km. (400 miles).

THE YaK-16.

U.S. Code Name: "Cork."

This medium-size transport is in service with Aeroflot on some of the shorter services.

The YaK-16 has also appeared with military markings as a light personnel transport and also in modified form as a trainer with a transparent nose section and a row of four astrodomes along the fuselage roof.

Type. — Twin-engined medium feeder-line transport.
Wings.—Low-wing cantilever monoplane. Metal construction and stressed skin covering. Ailerons and split trailing-edge flaps in outer wing panels.
Fuselage. — Metal monocoque structure.
Tail Unit.—Cantilever monoplane type with single fin and rudder. Metal construction and metal covering.
Landing Gear.—Retractable tail-wheel type. Cantilever oleo shock-absorbers. When gear is retracted, about half of each wheel remains exposed. Fixed sprung tail-wheel.
Power Plant.—Two ASh-21 seven-cylinder air-cooled single-row radial engines. Take-off power 750 b.h.p. at 2,300 r.p.m. at sea level; max. continuous cruising rating 680 b.h.p. at 1,900 r.p.m. VISh(a) two-blade metal controllable-pitch airscrews with large spinners. Three-blade airscrews may be fitted. Fuel capacity 1,800 litres (395 Imp. gallons) in wing tanks. Oil, 70 litres (15 Imp. gallons) in tank in centre section.
Accommodation.—Crew of two or three, and seats for ten passengers in main cabin. Five single seats down each side of central aisle. Entry door in port side at rear of cabin; small toilet compartment at rear

The YaK-16 Feeder-line Transport (two 750 h.p. ASh-21 engines).

of cabin opposite entry door. Freight compartment in rear of fuselage with access through door from main cabin.

DIMENSIONS.—
Span 20 m. (65 ft. 7 in.).
Length 14.5 m. (47 ft. 6 in.).
Height 3.6 m. (12 ft.).

WEIGHTS.—
Weight empty 5,000-5,200 kg. (11,000-11,450 lb.).
Max. payload 1,360 kg. (3,000 lb.).
Weight loaded 6,400 kg. (14,100 lb.).

PERFORMANCE.—
Max. speed 310 km.h. (190 m.p.h.).
Cruising speed at 1,700 m. (5,600 ft.) 290 km.h. (180 m.p.h.).
Landing speed 85 km.h. (53 m.p.h.).
Ceiling about 5,000 m. (16,400 ft.).
Single-engine ceiling 2,300 m. (7,550 ft.).
Optimum range 1,000 km. (620 miles).
Take-off run with 25 degree flaps 260 m. (855 ft.).

THE YaK-14 (YaK-12?).

U.S. Code Name: "Crow."

The production YaK-14 differs from the original 1944 version which has been described in previous editions of this Annual. The newer type, which has been called the YaK-12 in Russian and Polish sources, now has a stepped-down rear fuselage line and increased fin and rudder area. The present YaK-14 can be used as an ambulance, there being a large hatch in the rear fuselage for stretcher loading.

The new model began to replace the PO-2 trainer for certain duties in 1949, but it does not appear to have gone into civilian use on any significant scale.

TYPE.— Single - engined General - purpose monoplane.

WINGS.—High-wing monoplane braced to fuselage by V struts. All-wood structure. Leading-edge slots.

FUSELAGE.—Incorporates large hatch at port rear side suitable for loading stretcher cases.

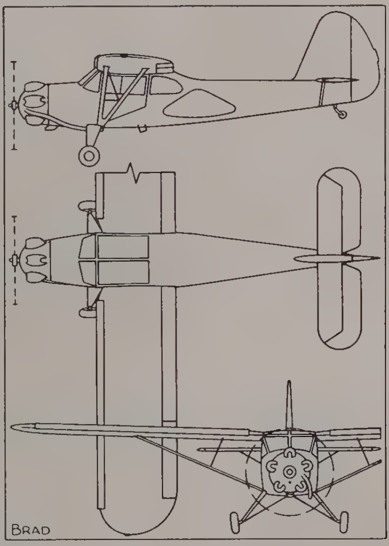
TAIL UNIT.—Fin and rudder larger than on prototype. Tailplane braced to fuselage.

LANDING GEAR.—Fixed tail-wheel type.

POWER PLANT.—One modern-series M-11 five-cylinder air-cooled radial engine of about 145 h.p., with individually cowled cylinder heads.

ACCOMMODATION.—Normally four seats. Can be adapted as ambulance.

DIMENSIONS (Approx.).—
Span 13.0 m. (42 ft. 8 in.).
Length 8.9 m. (29 ft. 1 in.).



The YaK-14 Light Transport.

PERFORMANCE.—
No reliable data available, except for prototype.

THE YaK-11.

U.S. Code Name: "Moose."

TYPE.—Two-seat intermediate and advanced trainer.

WINGS.—Low-wing cantilever monoplane. Sharp straight taper on leading and trailing-edges to rounded tips. Dihedral from roots. Small ailerons, and split flaps extending along trailing-edge from ailerons to meet at fuselage centre.

FUSELAGE.—Circular section forward, tapering in plan back to tail unit.

TAIL UNIT.—Cantilever monoplane type with single fin and rudder. Sharp straight taper on tailplane leading-edge, slight taper on trailing-edge, with rounded tips and cut-out for rudder movement. Inset elevators, with trim-tabs. Fin has straight leading-edge and rounded top; trailing-edge of rudder is rounded.

LANDING GEAR.—Retractable tail-wheel type. Main legs and wheels retract inwards to lie flush in wing beneath fuselage. Fixed tail-wheel.

POWER PLANT.—One ASh-21 seven-cylinder air-cooled single-row radial engine, using direct fuel injection. Take-off power 750 b.h.p. at 2,300 r.p.m. at sea level. Max. continuous cruising rating 680 b.h.p. at 1,900 r.p.m. VISh(a) two-blade metal controllable-pitch airscrew.

ACCOMMODATION.—Two seats in tandem beneath long "glass-house" enclosure raised above top line of fuselage.

ARMAMENT.—A single machine-gun can be installed on top port side of engine cowling for gunnery training.

EQUIPMENT.—Includes full radio receiver and transmitter sets.

DIMENSIONS.—
Span 9.3 m. (30 ft. 6 in.).
Length about 8.47 m. (27 ft. 9 in.).

WEIGHTS AND PERFORMANCE.—
No data available.

MISCELLANEOUS UNIDENTIFIED AIRCRAFT.

Hereafter are listed a number of Russian military aircraft which are known to exist but concerning which insufficient information is available to enable them to be positively identified.

1. A new single-jet single-seat Mikoyan(?) fighter which has been given the U.S. Code name **"Farmer,"** was also seen in quantity at Tushino in 1955. A formation of 47 or 48 flew at the Aviation Day Display, but few technical details are available. It is thought to be a development of the MIG-17, but the sweepback is around 60 degrees.

Until details of the power-plant are known it would be unwise to comment on the astounding claims made about this fighter's speed in level flight.

2. Publicly shown at Tushino in July, 1955 were seven large swept-wing bombers powered by four turboprop engines (U.S. code name **"Bear"**). They are of unknown type and capabilities.

The general layout can be gathered from the illustration. The bomber possesses a "chin" scanner radome, and each power unit drives two contra-rotating airscrews. Approximate dimensions are: span 57.8 m. (189 ft. 7 in.), length 42.2 m. (138 ft. 6 in.).

3. A twin-jet night or all-weather fighter was seen publicly for the first time at Tushino in July, 1955. Apart from its swept wing it is of fairly standard conception, perhaps corresponding to the Meteors Mks. 12-14.

Details of the engines, equipment or performance are not yet available. The

A trio of unidentified four-turboprop bombers referred to in paragraph 2.

large diameter of the fuselage compared with that of the power-plants suggests either a large fuel capacity or bulky airborne radar (or both) rather than that the engines are of the small German-derived types.

The general layout of the aeroplane can be gathered from the photograph.

4. The Type 37 (U.S. code name "**Bison**") four-jet heavy bomber was provisionally described in the 1954/1955 Edition of this Annual under the alleged Russian designation of TsAGI 428.

Since that time further details have become known although the team responsible for the design is not identified. In the description that follows, all quantitative data are estimates.

TYPE.—Long-range Heavy Bomber.
WINGS.—Mid-wing cantilever monoplane, with centre-section thickened to house engines. Anhedral when on ground.
FUSELAGE.—Circular section, with bomb-bay between wing roots.
TAIL UNIT.—Cantilever swept monoplane tailplane with dihedral. Swept fin and rudder.
LANDING GEAR.—Believed to consist of a tandem system with main wheels housed fore and aft of the bomb bay. Outrigger support wheels may be housed in the wing-tip fairings.
POWER PLANT.—Four gas turbines of unknown type, mounted at an angle such that jet exhausts do not impinge on the fuselage sides. Thrust at sea level thought to be approximately 9,300 kg. (20,500 lb.) each.
ACCOMMODATION.—Glazed nose with pilot's compartment above and behind this. Manned tail gun position.
ARMAMENT.—Gun installation uncertain. Normal bomb load 4,500 kg. (9,920 lb.), maximum bomb load 9,000 kg. (19,845 lb.).
EQUIPMENT.—Radome under nose, plentiful radio and radar equipment, considered to be of somewhat obsolescent design and badly positioned. Tail position appears to have radar warning.
DIMENSIONS (approx.).—
Span 52 m. (170 ft. 7 in.).
Length 49.5 m. (162 ft. 5 in.).
Wing area 340 m.² (3,660 sq. ft.).
WEIGHT.—
Loaded weight 165,600 kg. (365,110 lb.).
PERFORMANCE.—
Max. speed 900 km./hr. (559 m.p.h.).
Range 11,450 km. (7,100 miles).

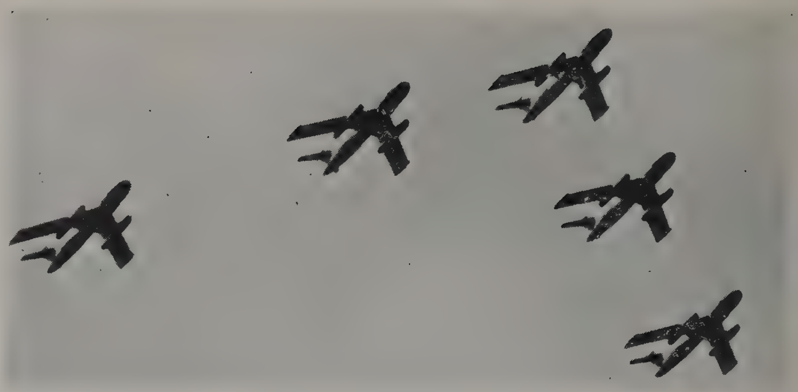
5. The Type 39 (U.S. code name "**Badger**") medium bomber appeared in numbers in 1954, and in July, 1955 a formation of 54 was publicly shown. The designation TsAGI 228 has been quoted but should be treated with reserve. The designer is not known with certainty though it is thought possible that it is derived from one of the prototypes of the Junkers EF 150. Quantitative data given below are estimates.

TYPE.—Twin-jet Medium Bomber.
WINGS.—High mid-wing cantilever monoplane with slight anhedral.
FUSELAGE.—Long circular-section structure.
TAIL UNIT.—Swept cantilever type with slight tailplane dihedral.
LANDING GEAR.—Nosewheel type, the main wheels retract into fairings projecting beyond the wing trailing-edge.
POWER PLANT.—Two gas turbines of unknown type. Thrust at sea level approximately 8,200 kg. (18,080 lb.).
ACCOMMODATION.—Glazed nose, manned tail position with lateral observation blisters for gunner.
ARMAMENT.—Gun installation unknown. Normal bomb load 4,500 kg. (9,920 lb.).
EQUIPMENT.—Scanner-type air-to-ground radome under nose. A number of "blisters" observable are thought to be part of radio and radar provision.
DIMENSIONS.
Span 35.4 m. (116 ft. 1 in.).
Length 36 m. (118 ft.).
Wing area 186 m.² (2,002 sq. ft.).
WEIGHT.—
Loaded weight 68,000 kg. (149,940 lb.).
PERFORMANCE.—
Max. speed 900 km.h. (559 m.p.h.).
Range 6,950 km. (4,320 miles).

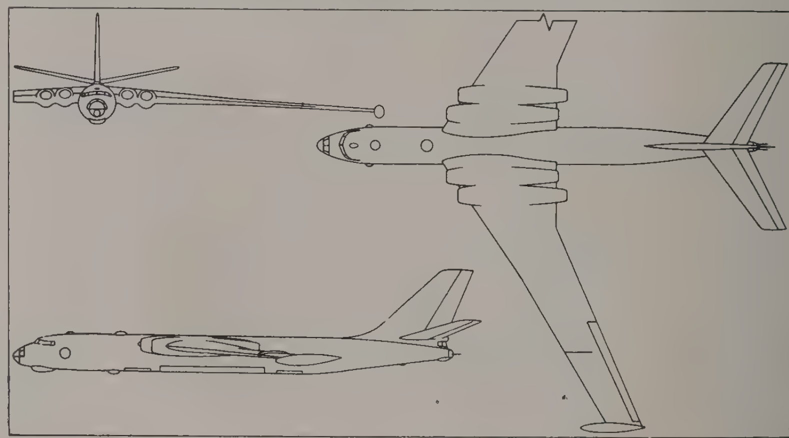
6. A small rocket-propelled interceptor has been developed for target-defence duties in the U.S.S.R., and it is in service in some numbers with the VVS. Its identity is not at present known, but it stems in conception from the Messerschmitt 163 and 263. It is a single-seat mid-wing monoplane of conventional layout, powered by a development of the Walther HWK 559, having twin effluxes under the rudder. The landing-gear is of the retractable nose-wheel type.

There are reports that improvements of this aeroplane have been produced, with auxiliary impulse-duct units. These, however are not fully verified.

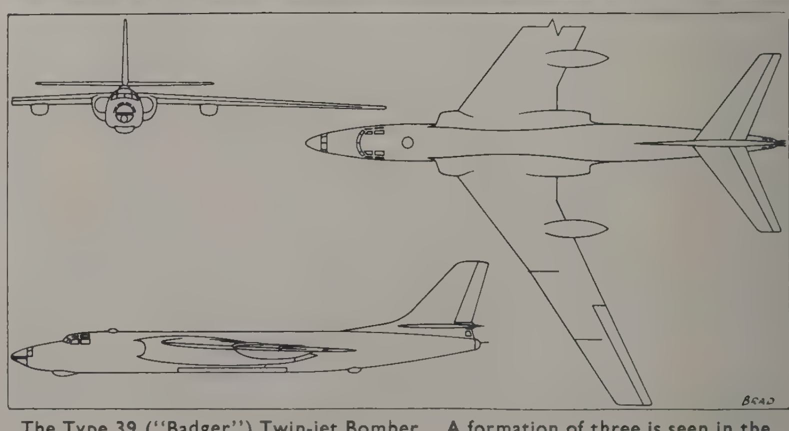
7. A swept-wing twin-jet bomber has been flying for some years in Russia, and a number of accounts state that it is a version of the IL-28. However, since the data is provisional and there are other twin-jet swept-wing aeroplanes in the U.S.S.R., it has not been deemed advisable to list this type as a definite Ily'ushin design at the moment.



A formation of twin-jet Night Fighters of the type referred to in paragraph 3.



The Type 37 ("Bison") Four-jet Heavy Bomber. See paragraph 4.



The Type 39 ("Badger") Twin-jet Bomber. A formation of three is seen in the photograph above. See paragraph 5.

SPAIN

AEROTECNICA

AEROTECNICA S.A.

HEAD OFFICE: CARRERA DE SAN JERONIMO 40, MADRID.

Aerotecnica S.A. has formed a helicopter department which it has placed under the technical direction of the French engineer Jean Cautinieau.

Aerotecnica began by engaging the services of M. Cautinieau and at the same time acquiring the Matra-Cautinieau MC-101 light helicopter which was built by the French Société Matra in 1952. This helicopter was given the designation AC-11 (Aerotecnica-Cautinieau-11).

From the AC-11 have been developed the AC-12 and AC-13, the former powered by a 150 h.p. Lycoming O-320 engine and the latter by a Turbomeca Artouste I gas turbine.

Two prototypes of the AC-12 have been built in Madrid, while two prototypes of the AC-13 have been built in France by the Société Nationale de Constructions Aéronautiques du Nord (S.N.C.A.N.), which has acquired a licence to build the AC-13 and by whom it is known as the Nord 1750 Norelfe. One of these two helicopters was built for Aerotecnica and the other has been retained by the S.N.C.A.N. for test.

The Aerotecnica AC-13 Helicopter (Turbomeca Artouste shaft turbine).

THE AEROTECNICA AC-12.

TYPE.—Two-seat Single-rotor Helicopter.

ROTOR.—Three-blade rotor with double-articulated blades. Each blade has a duralumin spar which forms the leading-edge, duralumin ribs and trailing-edge, and is covered by Klegecel, with a final overall covering of Fibreglas. Rotor blade area 0.9405 m.² (10.1 sq. ft.). Rotor disc area 57 m.² (613.3 sq. ft.). Three-blade anti-torque rotor of similar construction to main rotor. Anti-torque rotor blade area 0.0927 m.² (1.0 sq. ft.). Anti-torque rotor disc area 2.26 m.² (24.3 sq. ft.). The main rotor is driven direct from the engine gear-box (7.28 : 1 ratio) and clutch through a universal joint. The anti-torque rotor is driven through a gear-box (1.43 : 1 ratio) and cardan shaft.

FUSELAGE.—Light alloy structure.

LANDING GEAR.—Skid type. Track of skids 2.0 m. (6 ft. 6 in.).

POWER PLANT.—One 150 h.p. Lycoming O-320 fan-cooled engine mounted above the cabin with direct drive through the gear-box to the main rotor. Fuel tank behind cabin. Fuel capacity 90 litres (20 Imp. gallon).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Entrance door on each side of cabin.

DIMENSIONS.—
- Main rotor diameter 8.50 m. (27 ft. 10 in.).
- Overall length 7.35 m. (24 ft. 1 in.).
- Overall height (to top of rotor pylon) 2.75 m. (9 ft.).
- Width of fuselage 1.22 m. (4 ft.).
- Diameter of anti-torque rotor 1.70 m. (5 ft. 6 in.).

WEIGHTS.—
- Weight empty 480 kg. (1,056 lb.).
- Disposable load 240 kg. (528 lb.).
- Weight loaded 720 kg. (1,584 lb.).

PERFORMANCE.—
- Max. speed at S/L. 126 km.h. (78 m.p.h.).
- Cruising speed 108 km.h. (67 m.p.h.).
- Hovering ceiling without ground effect 1,340 m. (4,400 ft.).
- Hovering ceiling with ground effect 2,290 m. (7,500 ft.).
- Best rate of climb at S/L. 306 m./min. (1,000 ft./min.).
- Still air cruising range 216-324 km. (135-200 miles).

THE AEROTECNICA AC-13.

The AC-13 is similar in general arrangement to the AC-12 but is fitted with a Turbomeca Artouste I shaft turbine power-unit which drives the main rotor through clutch and gear-box. The residual thrust is ducted through the tubular rear fuselage and is used for torque compensation and direction control. For the latter the rear end of the jet duct is provided with an articulated extension with apertures to the right and left. Movement of this section is by pedal control. At low speeds this control is automatically transferred to two vertical control surfaces one on either side of the rear fuselage.

Further details of this helicopter will be found under S.N.C.A.N. (France) by whom it is designated Nord 1750 Norelfe.

AISA

AERONAUTICA INDUSTRIAL S.A.

HEAD OFFICE: ALCALA 10, MADRID.

WORKS AND AERODROME: CARABANCHEL ALTO, MADRID

President: Sr. Conde de Mieres.

Chairman: D. Lázaro Ros España.

This concern, with fully-equipped works and adjoining aerodrome at Carabanchel Alto (Madrid), has since 1923 been engaged in the manufacture, reconstruction and repair of aircraft of wood and mixed construction.

In 1943, three types were produced, the H.M.1 and H.M.5 trainers and the H.M.9 glider-tug. In 1945 the H.M.2 was completed and in 1947 prototypes of the H.M.3 seaplane and the H.M.7 four-seat cabin monoplane were built. All these aircraft, which have been illustrated and described in previous editions of "All the World's Aircraft," were designed by the Instituto Nacional de Técnica Aeronautica (INTA) and were built by the Aeronautica Industrial S.A. (AISA) in their works at Carabanchel Alto, near Madrid.

In 1946 AISA collaborated with Iberavia S.A. in the construction of various types of aircraft designed by that company, including the I-11 and I-115.

The Aircraft Department of Iberavia S.A. now been taken over by Aeronautica Industrial S.A. The designs taken over include two types of helicopters, the IH-52 of conventional design and the IH-51 which will be jet-driven. AISA is continuing the production of the I-11 and the I-115. It has also completed the I-11B, a developed version of the I-11 with a tail-wheel landing-gear. The prototype flew for the first time on October 16, 1953, and the aircraft is now going into series production for the use of aero clubs and for private pilots.

The latest product of Aeronautica Industrial S.A. is the AVD-12 three-seat liaison monoplane, the company's first all-metal aircraft. It was designed by the well-known French aircraft engineer Emile Dewoitine.

THE AISA AVD-12.

TYPE.—Three-seat cabin monoplane, suitable for liaison, training, and photography or ambulance duties.

WING.—High-wing cantilever monoplane. All-metal single-spar structure with torsion box leading-edge. Statically and aerodynamically balanced ailerons. Hydraulically-operated flaps inboard of ailerons. Total area of ailerons 2.130 m.² (22.9 sq. ft.). Total area of flaps 2.40 m.² (25.8 sq. ft.). Gross wing area 18 m.² (193.6 sq. ft.).

FUSELAGE.—Elleptical-section all-metal semi-monocoque structure

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Adjustable tailplane.

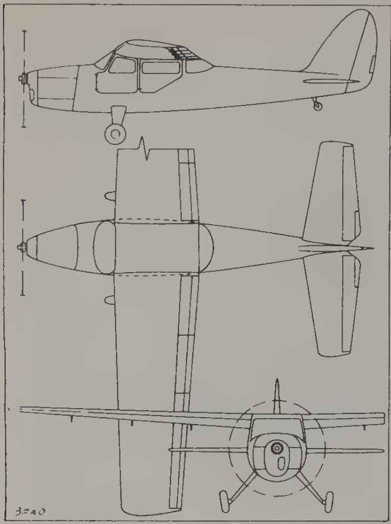
LANDING GEAR.—Fixed tail-wheel type. Single-strut cantilever legs with oleo-pneumatic springing within fuselage

POWER PLANT.—One 150 h.p. ENMA Tigre G-IV-B four-cylinder in-line inverted air-cooled engine on a welded steel tube mounting. ENH-P.8 two-blade metal airscrew.

ACCOMMODATION.—Cabin seats two side-by-side with dual controls, with third seat centrally behind.

DIMENSIONS —
- Span 11.1 m. (36 ft. 5 in.).
- Length 7.75 m. (25 ft. 5 in.).
- Height 2.10 m. (6 ft. 10½ in.).

The AISA AVD-12 (150 h.p. ENMA Tigre G-IV-B engine).



The AISA AVD-12.

Weights and Loadings (Designed).—
Weight empty 600 kg (1,320 lb.).
Normal loaded weight 900 kg. (1,980 lb.).
Max. permissible loaded weight 1,050 kg. (2,310 lb.).
Wing loading 52.75 kg./m.² (10.8 lb./sq. ft.).

Performance (Estimated).—
Max. speed 225 km.h. (140 m.p.h.).
Cruising speed (62.5% power) 182 km.h. (113 m.p.h.).
Min. speed 65 km.h. (40.3 m.p.h.).
Rate of climb at S/L. 275 m./min. (900 ft./min.).
Service ceiling 5,000 m. (16,400 ft.).
Range 750 km. (465 miles).

THE AISA I-115.

The first prototype I-115 flew for the first time on June 20, 1952. The aircraft is now going into production for the Spanish Air Force under the military designation E-6.

Type.—Two-seat Primary or single-seat Aerobatic Trainer.

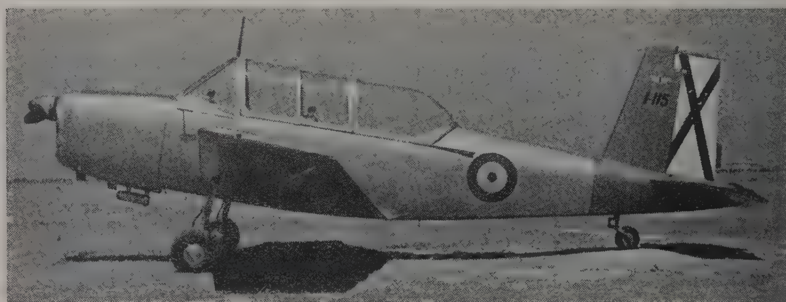
Wings.—Low-wing cantilever monoplane. NACA 23015/23009 wing section. Chord 1.96 m. (6 ft. 5 in.) at root, 0.98 m. (3 ft. 2 in.) at tip. Dihedral 6°. Incidence 3°. Single-piece two-spar all-wood structure with stressed plywood skin. Slotted flaps and differentially-operated ailerons have plywood frames and leading-edges and overall fabric covering. Ailerons droop when flaps lowered. Total area of flaps 1.59 m.² (17.1 sq. ft.). Total area of ailerons 1.19 m.² (12.8 sq. ft.). Gross wing area 14.0 m.² (150.6 sq. ft.).

Fuselage.—All-wood monocoque structure.

Tail Unit.—Cantilever monoplane type. Structure and tab arrangements as for I-11. Areas: fin 0.65 m.² (6.9 sq. ft.), rudder 0.55 m.² (5.9 sq. ft.), tailplane 1.56 m.² (16.7 sq. ft.), elevators 1.02 m.² (10.9 sq. ft.). Span of tailplane 3.2 m. (10 ft. 6 in.).

Landing Gear.—Fixed tail-wheel type. Oil/spring shock-absorbers. Hydraulic wheel brakes. Tail-wheel is linked to rudder-bar but may be disconnected at will by pilot.

Power Plant.—One 150 h.p. ENMA Tigre G-IV-B four-cylinder in-line inverted air-cooled engine. P8 two-blade metal airscrew with pitch adjustable on ground. Two fuel tanks in wings. Total fuel capacity 135 litres (30 Imp. gallons).



The AISA I-115 Two-seat Trainer (150 h.p. ENMA Tigre G-IV-B engine).

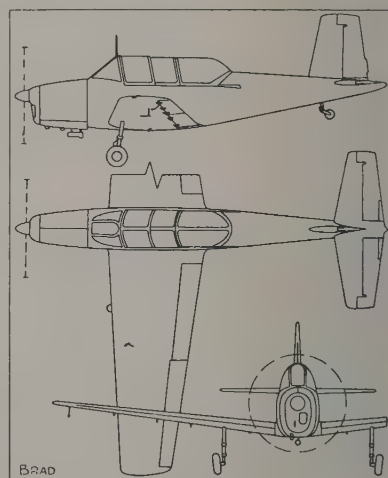
Accommodation.—Tandem cockpits under continuous canopy with sliding section over each cockpit. Complete dual controls and instrumentation. Equipment includes Iberabia ITR 6 radio transmitter/receiver and Marconi artificial horizon. Small baggage compartment behind rear seat accessible from outside.

Dimensions.—
Span 9.54 m. (31 ft. 3 in.).
Length 7.35 m. (24 ft. 1 in.).
Height 2.10 m. (6 ft. 10 in.).

Weights and Loadings (Two-seater).—
Weight empty 612 kg. (1,346 lb.).
Weight loaded 900 kg. (1,980 lb.).
Wing loading 64.3 kg./m.² (13.18 lb./sq. ft.).

Power Loading 5.06 kg./h.p. (11.13 lb./h.p.).

Performance (two-seater, fully loaded).—
Max. speed 240 km.h. (149 m.p.h.).
Cruising speed 204 km.h. (126.6 m.p.h.),
Landing speed with flaps 81.5 km.h. (50.6 m.p.h.).
Initial rate of climb 225 m./min. (686 ft./min.).
Service ceiling 4,400 m. (14,430 ft.).
Take-off distance to 15 m. (50 ft.) 380 m. (415 yds.).
Landing distance from 15 m. (50 ft.) 350 m. (382 yds.).
Duration (70% power) 3½ hours.



The AISA I-115.

THE AISA I-11 PEQUE.

Type.—Two-seat Light Touring or Elementary Training monoplane.

Wings.—Low-wing cantilever monoplane. NACA 23015/23009 wing section. Root chord 1.74 m. (5 ft. 8 in.), tip chord 1.14 m. (3 ft. 9 in.). Dihedral 7°. Incidence 3°. Two-spar wood structure with plywood skin. Differentially-operated ailerons have wood frames and leading-edge and overall fabric covering. Total aileron area 1.39 m.² (14.9 sq. ft.). Wing area 13.5 m.² (145.2 sq. ft.).

Fuselage.—All-wood monocoque structure.

Tail Unit.—Cantilever monoplane type. Fixed surfaces have two spars and plywood skin. Movable surfaces have wood frames and leading-edges a fabric covering. Trim-tabs in elevators. Rudder tab is adjustable on ground only. Areas: fin 0.59 m.² (6.3 sq. ft.), rudder 0.36 m.² (3.8 sq. ft.), tailplane 1.35 m.² (14.5 sq. ft.), elevators 0.74 m.² (7.9 sq. ft.). Span of tailplane 2.9 m. (9 ft. 6 in.).

Landing Gear.—Fixed tricycle type. Oil/spring shock-absorbers. Steerable nose-wheel. Hydraulic brakes.

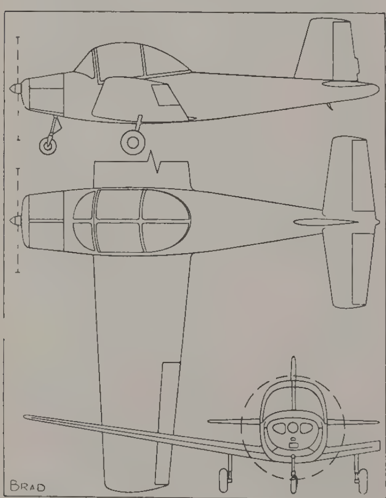
Power Plant.—One 90 h.p. Continental C90-12F four-cylinder horizontally-opposed air-cooled engine driving a two-blade Aeromatic or fixed-pitch wood airscrew. Total fuel capacity 80 litres (17.6 Imp. gallons).

Accommodation.—Two side-by-side seats with dual controls under "blister" type canopy. Baggage space aft of seats.

Dimensions.—
Span 9.36 m. (30 ft. 7 in.).
Length 6.40 m. (21 ft.).
Height 2.39 m. (7 ft. 10 in.).

Weights and Loadings.—
Weight empty 460 kg. (1,012 lb.).
Weight loaded 700 kg. (1,540 lb.).
Wing loading 51.8 kg./m.² (10.6 lb./sq. ft.).
Power loading 8.2 kg./h.p. (18.0 lb./h.p.).

Performance.—
Max. speed 196 km.h. (122 m.p.h.).
Cruising speed (70% power) 174 km.h. (108 m.p.h.).
Min. speed 86 km.h. (53.4 m.p.h.).
Initial rate of climb 195 m./min. (640 ft./min.).
Service ceiling 4,000 m. (13,120 ft.).
Range 700 km. (435 miles).



The AISA I-11 Peque.

The AISA I-11 Peque (90 h.p. Continental C90 engine).

THE AISA I-11B.

The I-11B is similar to the I-11 previously described, but is fitted with a tail-wheel landing-gear and wing flaps. It is fully aerobatic when flown as a single-seater.

TYPE.—Two-seat touring or training monoplane.

WINGS.—Low-wing cantilever monoplane. Wing section and structure as for I-11. Two-position flaps between ailerons and fuselage. Total flap area 1.4 m.² (15 sq. ft.). Total aileron area 1.116 m.² (11.6 sq. ft.). Gross wing area 13.4 m.² (144 sq. ft.).

FUSELAGE.—As for I-11.

TAIL UNIT.—Cantilever monoplane type. Structure as for I-11. Single-piece elevator has semi-automatic trim-tabs. Rudder tab adjustable on ground only. Areas: fin 0.629 m.² (6.76 sq. ft.), rudder 0.475 m.² (5.11 sq. ft.), tailplane 1.595 m.² (17.16 sq. ft.), elevator 0.894 m.² (9.62 sq. ft.). Span of tailplane 3.04 m. (10 ft.).

LANDING GEAR.—Fixed tail-wheel type. Oil/spring shock-absorbers. Hydraulic wheel-brakes. Steerable tail-wheel. Track 2.70 m. (8 ft. 10 in.).

POWER PLANT.—Same as for I-11.

ACCOMMODATION.—Same as for I-11.

DIMENSIONS.—
Span 9.340 m. (30 ft. 7 in.).
Length 6.468 m. (21 ft. 3 in.).
Height (tail down) 1.900 m. (6 ft. 3 in.).

WEIGHTS AND LOADINGS.—
Weight empty 421 kg. (926 lb.).
Normal loaded weight 644 kg. (1,417 lb.).
Max. permissible weight (semi-aerobatic category) 670 kg. (1,474 lb.).
Max. permissible weight (full aerobatic category) 570 kg. (1,254 lb.).
Normal wing loading 48 kg./m.² (9.84 lb./sq. ft.).
Normal power loading 7.15 kg./h.p. (15.7 lb./h.p.).

PERFORMANCE (at normal loaded weight).—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 177 km.h. (110 m.p.h.).
Min. speed 76 km.h. (47.2 m.p.h.).
Rate of climb at S/L. 220 m./min. (726 ft./min.).
Service ceiling 4,700 m. (15,415 ft.).
Range 650 km. (403 miles).

The AISA I-11B (90 h.p. Continental C90 engine).

CASA

CONSTRUCCIONES AERONAUTICAS S.A.

HEAD OFFICE: CALLE REY FRANCISCO No. 4, MADRID.

WORKS: MADRID, GETAFE, SEVILLE AND CADIZ.

President: Don Victor Chavarri Anduiza.

Vice-President: Don José Lacalle Larraga.

Counsellor-Deputy: Don José Ortíz Echagüe.

Managing Director: Don Francisco Díaz Iboléon.

Consulting Engineer: Don Francisco Lozano Aguirre.

Engineer in charge of Projects: Don Pedro Huarte-Medicoa Larraga.

Engineer in charge of Production: Don Eugenio Aguirre Castillo.

Engineer in charge of Administration: Don Emilio de la Guardia Ruiz.

This important concern has four factories wherein are built various types of all-metal military aircraft of national and foreign design for the Spanish Air Force.

In 1949, CASA completed the first twin-engined aircraft of Spanish design, the CASA-201. The first units of a small production series have already been delivered.

Flight tests have been completed with the prototype of a second twin-engined aircraft of the firm's own design, the CASA-202, a series of 20 of which is now being built. The prototype flew for the first time in May, 1952.

The company's latest product is the twin-engined 30/38 passenger airliner known as the CASA-207. This aircraft made its first flight in 1955.

THE CASA-201 ALCOTAN.

The CASA-201, which flew for the first time in February, 1949, was the first twin-engined aircraft of original Spanish design and construction.

Several versions of the CASA-201 now being developed, have the following designations and functions:—

201-A. Passenger version. Two Armstrong Siddeley Cheetah 27 engines.

201B. Passenger version. Two ENMA Sirio-VII-A engines.

201-D. Navigation, Radio, Multi-engine and Blind-flying training aircraft. Two Armstrong Siddeley Cheetah 27 engines.

201-E. Bombing and Photographic Training aircraft. Two Armstrong Siddeley Cheetah 27 engines.

201-F and G. Same as 201-D and E, but with two ENMA Sirio-VII-A engines.

TYPE.—Twin-engined Light Transport.

WINGS.—Low-wing cantilever monoplane. Wing in three sections comprising centre-section and two tapering outer sections set at 6° dihedral. All-metal two-spar structure. Hydraulically-operated flaps inboard of ailerons, the latter being inter-connected with the flaps and arranged to droop to augment flap area for landing. Wing area 41.80 m.² (450 sq. ft.).

FUSELAGE. — All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal tailplane and fin, metal framed fabric-covered rudder and elevators.

LANDING GEAR.—Retractable tail-wheel type. Hydraulic operation.

POWER PLANT.—Two Armstrong Siddeley Cheetah 27 seven-cylinder radial air-cooled engines, each with a normal rated output of 385 h.p. and with 475 h.p. available for take-off, or two ENMA Sirio-VIIA seven-cylinder radial engines, each with a normal rated output of 440 h.p. and with 500 h.p. available for take-off. Fuel tanks in wings.

ACCOMMODATION.—Crew of two and ten passengers. Cabin heating. Night-flying equipment.

DIMENSIONS.—
Span 18.40 m. (60 ft. 4 in.).
Length 13.80 m. (45 ft. 3 in.).
Height 3.85 m. (12 ft. 8 in.).

WEIGHTS AND LOADINGS (Cheetah engines).—
Weight empty 3,560 kg. (7,830 lb.).
Weight loaded 5,100 kg. (11,230 lb.).
Wing loading 122 kg./m.² (25 lb./sq. ft.).
Power loading 5.37 kg./h.p. (11.8 lb./h.p.).

WEIGHTS AND LOADINGS (Sirio engines).—
Weight empty 3,600 kg. (7,920 lb.).
Weight loaded 5,500 kg. (12,100 lb.).
Wing loading 131 kg./m.² (26.8 lb./sq. ft.).
Power loading 6.11 kg./h.p. (13.5 lb./h.p.).

PERFORMANCE (Cheetah engines).—
Max. speed 325 km.h. (203 m.p.h.).
Landing speed 112 km.h. (70 m.p.h.).
Service ceiling 5,600 m. (18,370 ft.).
Range 1,000 km. (621 miles).
Duration 4 hours.

PERFORMANCE (Sirio engines).—
Max. speed 350 km.h. (219 m.p.h.).
Landing speed 117 km.h. (73 m.p.h.).
Service ceiling 6,100 m. (20,000 ft.).
Range 1,000 km. (621 miles).
Duration 4 hours.

THE CASA-202 HALCÓN.

TYPE.—Twin-engined Transport.

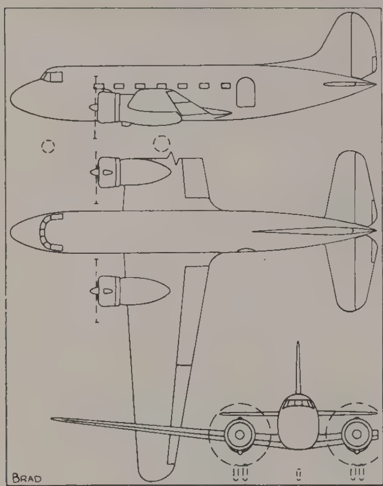
WINGS.—Low-wing cantilever monoplane. Wing section NACA 23018 at root, 23009 at tip. Aspect ratio 8.11. Dihedral 6°. Chord 4.1 m. (13 ft. 5 in.) at root, 1.3 m. (4 ft. 3 in.) at tip. All-metal two-spar structure. Metal framed fabric covered ailerons. Total area of ailerons 4.4 m.² (47.3 sq. ft.). All-metal trailing-edge flaps. Total area of flaps 6.8 m.² (73.2 sq. ft.). Gross wing area 57.40 m.² (617.6 sq. ft.).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal fin and tail-plane, metal-framed fabric-covered rudder and elevators. Areas: fin 2.8 m.² (30.1 sq. ft.), rudder 2.3 m.² (24.7 sq. ft.), elevators (total) 4.7 m.² (50.6 sq. ft.), tailplane 7.7 m.² (82.9 sq. ft.).

The CASA-201 Alcotan Light Transport (two 475 h.p. Armstrong Siddeley Cheetah 27 engines).

The CASA-202 Halcón Airliner (two 775 h.p. ENMA Beta engines).



The CASA-202 Halcón.

Landing Gear.—Retractable nose-wheel type. Hydraulic operation. Oleo shock-absorbers. Dual main wheels. Hydraulic brakes. Track 5.172 m. (16 ft. $11\frac{1}{2}$ in.). Wheelbase 4.90 m. (16 ft. 1 in.).

Power Plant.—Two ENMA Beta 9C-29-750 nine-cylinder radial air-cooled engines, each with normal rating of 750 h.p. and with 775 h.p. available for take-off. Fuel tanks in wings, two in centre-section of 530 litres (116 Imp. gallons) each, and two in outer wings of 540 litres (119 Imp. gals.) each. Total fuel capacity 2,140 litres (470 Imp. gals.).

Accommodation.—Crew of three and fourteen passengers. Cabin heated and air-conditioned. Night flying equipment.

Dimensions.—
- Span 21.58 m. (70 ft. 9 in.).
- Length 16.0 m. (52 ft. 6 in.).
- Height 3.81 m. (12 ft. 6 in.).

Weights and Loadings.—
- Weight empty 5,267 kg. (11,615 lb.).
- Max. disposable load 2,483 kg. (5,475 lb.).
- Weight loaded 7,750 kg. (17,090 lb.).
- Wing loading 135 kg./m.^{2} (27.67 lb./sq. ft.).

Performance.—
- Max. speed at S/L. 310 km.h. (192.5 m.p.h.).
- Max. speed at 2,840 m. (9,315 ft.) 370 km.h. (230 m.p.h.).
- Cruising speed (70% power) 330 km.h. (205 m.p.h.).
- Landing speed 117 km.h. (72.6 m.p.h.).
- Service ceiling 7,300 m. (23,950 ft.).
- Service ceiling on one engine 3,000 m. (9,840 ft.).

THE CASA-207 AZOR.

Type.—Twin-engined Airliner.

Wings.—Low-wing cantilever monoplane. Wing section NACA 23018 at root, NACA 23010 at tip. Aspect ratio 9. Chord 4.65 m. (15 ft. 3 in.) at root, 1.54 m. (5 ft. 1 in.) at tip. Dihedral 4°. Incidence 4°. All-metal two-spar structure. Metal framed fabric-covered ailerons. Hydraulically-operated all-metal trailing-edge flaps inboard of ailerons, the latter arranged to droop to augment flap area. Total aileron area 5.95 m.^{2} (64 sq. ft.). Total flap area 11.67 m.^{2} (125.6 sq. ft.). Gross wing area 85.8 m.^{2} (923.2 sq. ft.).

Fuselage.—All-metal semi-monocoque structure.

Tail Unit.—Cantilever monoplane type. All-metal fin and tailplane, metal-framed fabric-covered rudder and elevators. Areas: fin 6.34 m.^{2} (68.2 sq. ft.), rudder 4.08 m.^{2} (43.9 sq. ft.), tailplane 13.86 m.^{2} (149.1 sq. ft.), elevators 6.26 m.^{2} (67.4 sq. ft.). Tail-plane span 10.0 m. (32 ft. 10 in.).

Landing Gear.—Retractable nose-wheel type. Hydraulic retraction. Oleo-pneumatic shock-absorbers. Dual main wheels. Hydraulic brakes. Wheelbase 6.155 m. (20 ft. 2 in.). Track 6.883 m. (22 ft. 7 in.).

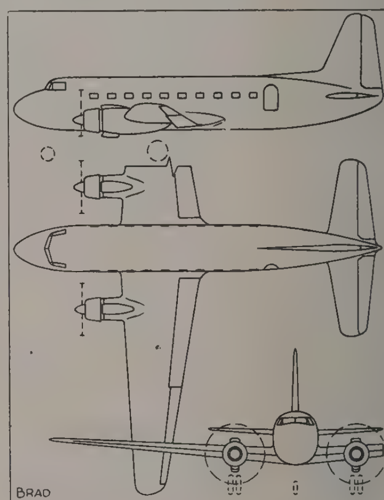
Power Plant.—Two 2,040 h.p. Bristol Hercules 730 fourteen-cylinder sleeve-valve air-cooled engines. D.H. 4/4000/C constant-speed airscrews. Fuel tanks in wings, two in centre-section (985 litres = 217 Imp. gallons each) and two in inner wing panels (550 litres = 121 Imp. gallons each). Total fuel capacity 3,070 litres (676 Imp. gallons). Oil capacity 140 litres (30 Imp. gallons) in two tanks.

Accommodation.—Crew of 4 and 30-38 passengers. Cabin heated and air-conditioned.

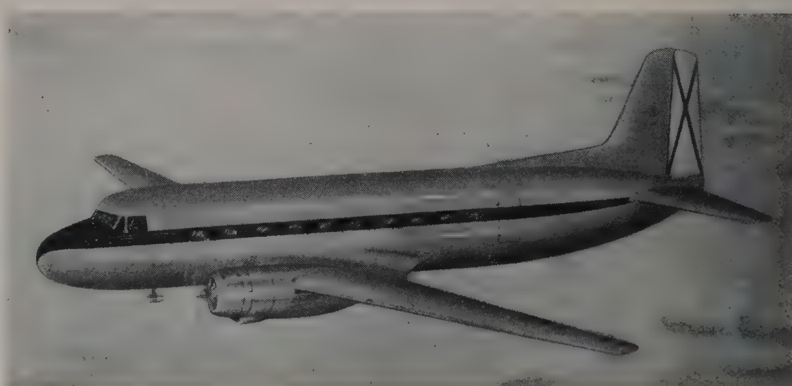
Dimensions.—
- Span 27.80 m. (91 ft. 1 in.).
- Length 20.85 m. (91 ft. 1 in.).
- Height 7.75 m. (25 ft. 5 in.).

Weights (Designed).—
- Weight empty 9,820 kg. (21,655 lb.).
- Crew 320 kg. (705 lb.).
- Passengers 2,316 kg. (5,100 lb.).
- Fuel and oil 2,074 kg. 14.575 lb.).
- Freight and baggage 470 kg. (1,035 lb.).
- Weight loaded 15,000 kg. (33,075 lb.).

Performance (Estimated).—
- Max. speed at 1,525 m. (5,000 ft.) 423 km.h. (263 m.p.h.).
- Cruising speed at 3,050 m. (10,000 ft.) 346 km.h. (215 m.p.h.).
- Stalling speed (with flaps) 140 km.h. (87 m.p.h.).
- Service ceiling 7,700 m. (25,250 ft.).
- Range (with crew of 4, 30 passengers and 15 kg. (33 lb.) of baggage per passenger) 1,750 km. (1,100 miles).



The CASA-207 Azor Airliner.



A drawing of the CASA-207 Azor Airliner.

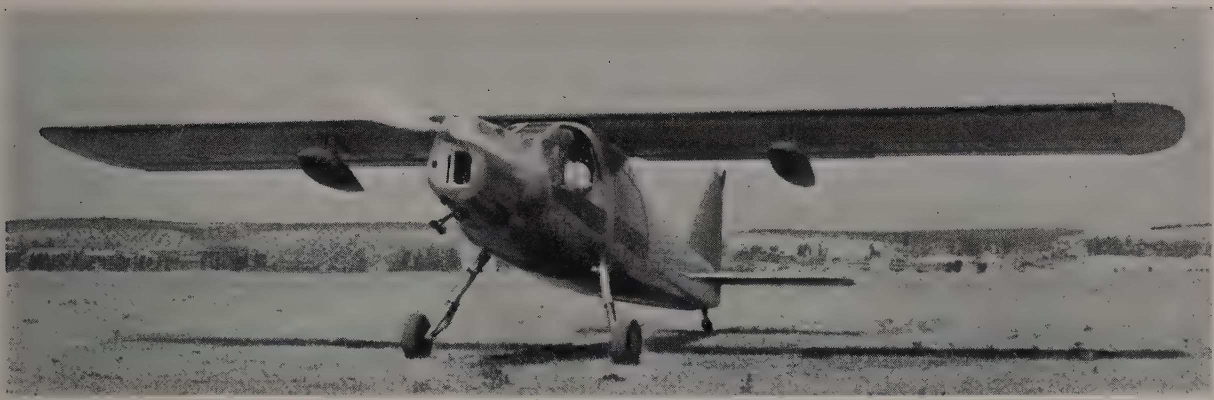
DORNIER

OFICINAS TECNICAS DORNIER.

Head Office: Cde. Peñalver 92, Madrid.

Because the design and manufacture of aircraft is prohibited in Germany, the well-known German Dornier organisation has established technical offices in Spain and has designed and built its first post-war aircraft, the Do 25, there. A brief description of this interesting aircraft follows.

Dr. Ing. Claude Dornier began the development of all-metal aircraft in the early days of World War I at Friedrichshafen, where he had the active support and collaboration of the great Zeppelin company. The first Dornier metal aircraft were built by the Zeppelin Werk Lindau G.m.b.H. but in 1922 the name of the company was changed to Dornier Metallbauten G.m.b.H. A sister company, the A.G. für Dornier-Flugzeuge, was established in 1926 at Alternrheim, on the neighbouring Swiss shores of Lake Constance, for the production of military aircraft, the construction of which was then prohibited in Germany. Licenses to build Dornier aircraft were also granted



The Dornier Do 25 General Utility Monoplane (150 h.p. ENMA Tigre engine).

between the wars to firms in Italy, Spain, Holland and Japan.

The best-known of a long line of Dornier aircraft were probably the Wal flying-boat of the inter-war years and the Do 217 of the last war.

THE DORNIER Do 25.

The Do 25 was designed as a general purpose monoplane for operations out of small unprepared fields. Special emphasis has been given to producing an aircraft possessing excellent slow-flying qualities, good forward visibility and ease of loading and maintenance. The prototype was fitted with a 150 h.p. ENMA Tigre engine. A second model powered by a 225 h.p. Continental O-470-J engine is known as the Do 27.

The Do 27, which is illustrated below, flew for the first time on June 27, 1955.

TYPE.—Single-engined General Purpose monoplane.

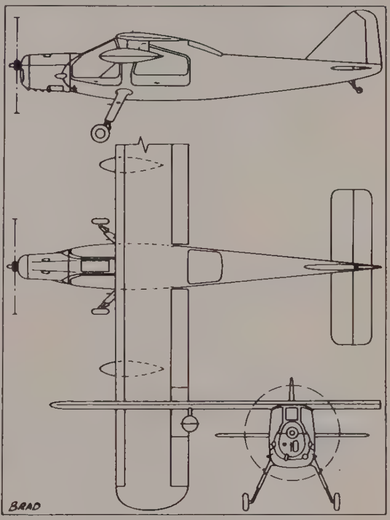
WINGS.—High-wing cantilever monoplane. All-metal structure. Forward portion of wing is a metal-skinned torsion box with a built-in fixed slot over whole of span. Aft of wing, flaps and ailerons are fabric-covered. Double-slotted flaps interconnected with ailerons. Detachable wing-tips.

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. Fin and tailplane are all-metal with flush-riveted stressed-skin covering. Rudder and elevators have metal frames and fabric covering. Tailplane incidence adjustable in flight.

LANDING GEAR.—Fixed type. Cantilever oleo-pneumatic shock struts. Hydraulic brakes. Full-castoring and steerable tail-wheel.

POWER PLANT.—One 150 h.p, ENMA Tigre four-cylinder in-line inverted air-cooled engine. ENMA metal airscrew. Two underwing drop tanks with a total fuel capacity of 120 litres (26.4 Imp. gallons).



The Dornier Do 25.

ACCOMMODATION.—Enclosed cabin seating two side-by-side in front with ample space aft for varying loads. Cabin dimensions 3.00 m. long × 120 m. wide × 1.25 m. high (9 ft. 10 in. × 3 ft. 11 in. × 4 ft. 1 in.). Cargo loading doors, 0.83 m. × 1.20 m. (2 ft. 9 in. × 3 ft. 11 in.), on each side of rear cabin.

DIMENSIONS.—
Span 12.0 m. (39 ft. 4 in.).
Length 9.4 m. (30 ft. 10 in.).
Height 3.1 m. (10 ft. 2 in.).

WEIGHTS AND PERFORMANCES.—
No data available.

The Dornier Do 27 (225 h.p. Continental O-470 engine).

HISPANO

LA HISPANO AVIACIÓN S.A.

HEAD OFFICE: AVENIDA JOSÉ ANTONIO 7. MADRID.

AIRCRAFT WORKS: SEVILLE.

The controlling interest in Hispano Aviacion, S.A. is held by Hispano Suiza S.A.

The company is in production with the HA-43, the HA-100-E1, the HA-1109 and the HA-1110. The HA-43 is a two-seat monoplane suitable for the training of pilots and observers. The model now in production is the HA-43-D2. The HA-1109-K1L is a development of the Messerschmitt Me 109 with an Hispano-Suiza engine and other changes meeting Spanish requirements. The HA-1109-MIL is fitted with a Rolls-Royce Merlin 500-45 engine and Rotol airscrew. Other versions of the Me 109 being built are the HA-1110-KIL, a two-seat trainer version of the HA-1109-KIL, and the HA-1109-K2L and HA-1112-K1L, which are also derived from the HA-1109-K1L but are fitted with differing armaments.

La Hispano Aviacion has under development the HA-110-C1 and HA-200-R1. The HA-110-C1 is a derivative of the HA-100-E1 with a different power-plant; and the HA-200-R1 is a twin-jet two-seat conversion trainer. The prototype HA-200-R1 made its first flight on August 16, 1955.

THE HISPANO HA-43-D2.

TYPE.—Two-seat Advanced Trainer.

WINGS.—Low-wing cantilever monoplane NACA 230 Series wing section. Aspect ratio 6.13. Chord (mean) 1.734 m. (5 ft. 8¼ in.). Dihedral 6°. Incidence 1° 17′. All-wood structure with plywood covering. Hydraulically-operated flaps and statically and dynamically balanced ailerons. Flap and aileron controls interconnected so that ailerons droop when flaps are lowered. Gross wing area 16.3 m.^{2} (175.4 sq. ft.).

FUSELAGE—Oval section with basic structure of welded chrome-molybdenum steel tubing and covering of duralumin sheet panels and fabric.

TAIL UNIT.—Braced monoplane type. Welded steel tube framework covered with fabric. Statically-balanced control surfaces with controllable trim-tabs. Areas: fin 0.386 m.^{2} (4.15 sq. ft.), rudder 0.787 m.^{2} (8.47 sq. ft.), tailplane 1.374 m.^{2} (14.78

The Hispano HA-1110-KIL Two-seat Fighter Trainer.

sq. ft.), elevators 1.256 m.² (13.51 sq. ft.). Tailplane span 3.30 m. (10 ft. 9¾ in.).

Landing Gear.—Retractable tricycle type. Hydraulic retraction. Oleo-pneumatic shock-absorbers. Hispano Aviacion wheels with medium-pressure tyres. Hispano Aviacion brakes. Track 2.88 m. (9 ft. 5 in.).

Power Plant.—One 390 h.p. Armstrong Siddeley Cheetah 27 seven-cylinder radial air-cooled geared and supercharged engine driving a Rotol controllable-pitch airscrew with wood blades. Airscrew diameter 2.84 m. (9 ft. 4 in.) diameter. Fuel tanks in fuselage and centre-section. Total fuel capacity 400 litres (88 Imp. gallons). Oil capacity 25 litres (6 Imp. gallons).

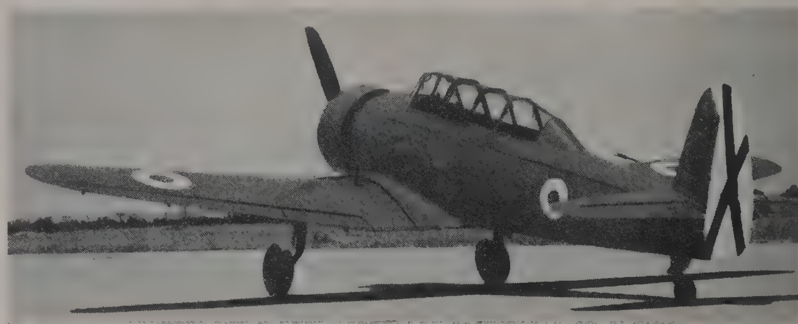
Accommodation.—Tandem cockpits under continuous canopy with separate sliding sections over cockpits. Dual controls.

Equipment.—Includes two Breda 7.7 mm. machine-guns in wings (200 r.p.g.) six rockets, three under each wing, radio, night-flying equipment, etc.

Dimensions.—
- Span 10.00 m. (32 ft. 10 in.).
- Length 7.95 m. (26 ft. 2 in.).
- Height 2.60 m. (8 ft. 6 in.).

Weights and Loadings.—
- Weight empty 1,504 kg. (3,309 lb.).
- Disposable load 546 kg. (1,201 lb.).
- Weight loaded 2,050 kg. (4,510 lb.).
- Wing loading 126 kg./m.² (25.8 lb./sq. ft.).

Performance.—
- Max. speed 335 km.h. (208 m.p.h.).
- Average cruising speed 295 km.h. (183 m.p.h.).
- Stalling speed 128 km.h. (79.5 m.p.h.).
- Stalling speed (flaps down) 118 km.h. (73 m.p.h.).
- Rate of climb 480 m./min. (1,410 ft./min.).
- Ceiling 6,000 m. (19,680 ft.).
- Normal cruising range 1,200 km. (745 miles).
- Normal duration 4 hours 15 min.



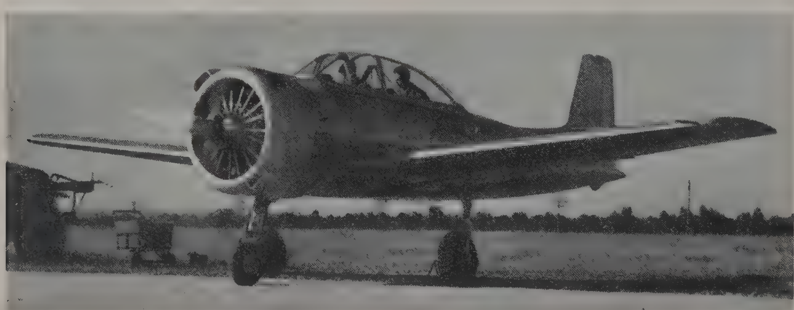
Two views of the Hispano HA-43-DI Advanced Trainer.

THE HISPANO HA-100-E1.

Type.—Two-seat Operational Trainer.

Wings.—Low-wing cantilever monoplane. 63_2A015, 64_2A015, 63_2A013 and 64_2A013 wing sections. Aspect ratio 6.25. Chord 1.985 m. (6 ft. 6 in.) at root, 1.274 m. (4 ft. 2 in.) at tip. Dihedral 5°. Incidence 4°. Single spar duralumin and Alclad structure. All-metal flaps. All-metal statically and aerodynamically balanced ailerons. Total area of flaps 2.275 m.² (24.5 sq. ft.). Total aileron area 1.456 m.² (15.6 sq. ft.). Gross wing area 17.35 m.² (186.6 sq. ft.).

Fuselage.—Circular section semi-monocoque structure of duralumin and Alclad.



The Hispano HA-100-EI Operational Trainer.

Tail Unit.—Cantilever monoplane type. All-metal structure. Areas: fin 1.32 m.² (14.2 sq. ft.), rudder 0.68 m.² (7.3 sq. ft.), tailplane 2.41 m.² (25.9 sq. ft.), elevators 0.6025 m.² (6.5 sq. ft.). Tailplane span 3.10 m. (10 ft. 2 in.).

Landing Gear.—Retractable nose-wheel type. Hydraulic retraction. Hydraulic shock-absorbers. Dunlop wheels, tyres and hydraulic brakes. Track 2.88 m. (9 ft. 5 in.). Wheelbase 1.652 m. (5 ft. 5 in.).

Power Plant.—One 755 h.p. ENMA Beta B-4 nine-cylinder radial air-cooled engine. de Havilland 4/2000/40SAE constant-speed airscrew. One fuel tank in fuselage (376 litres = 83 Imp gallons) and two in wings (109 litres = 24 Imp. gallons each). Total fuel capacity 600 litres (132 Imp. gallons). Oil capacity 60 litres (13.2 Imp. gallons).

Accommodation.—Two seats in tandem undei sliding two-section canopy. Dual controls and duplicated instrument panels.

Armament.—Two CETME 12.7 mm. machine-guns and racks for four 8 kg. rockets oi 4 × 50 kg. bombs.

Equipment.—Complete instrumentation for blind flying training. VHF, radio compass and ILS. Oxygen equipment. Ciné camera.

Dimensions.—
- Span 10.4 m. (34 ft. 1 in.).
- Length 8.47 m. (27 ft. 9 in.).
- Height 3.37 m. (11 ft.).

Weights.—
- Weight empty 1,827 kg. (4,020 lb.).
- Useful load 635 kg. (1,397 lb.).
- Disposable load 1,045 kg. (2,300 lb.).
- Weight loaded 2,872 kg. (6,320 lb.).

Performance (Estimated).—
- Max. speed at S/L. 415 km.h. (258 m.p.h.).
- Cruising speed (70% power) at 2,900 m. (9,150 ft.) 381.5 km.h. (237 m.p.h.).
- Stalling speed 104 km.h. (64.5 m.p.h.).
- Landing speed 128.2 km.h. (79.6 m.p.h.).
- Initial rate of climb 650 m./min. (2,132 ft./min.).
- Service ceiling 10,250 m. (33,620 ft.).
- Range 1,323 km. (821 miles).
- Endurance 3 hours, 28 mins.

THE HISPANO HA-200-R1.

Military designation: XE-14.

Type.—Twin-jet Two-seat Conversion Trainer.

Wings. Low-wing cantilever monoplane. Aspect ratio 6.22. Chord 1.985 m. (6 ft. 6 in.) at root, 1.274 m. (4 ft. 2 in.) at tip. Dihedral 3.5°. Incidence 4°. Single-spar structure of duralumin and Alclad. Split trailing-edge flaps. Statically and aerodynamically balanced all-metal ailerons. Total aileron area 1.0462 m.² (11.25 sq. ft.). Gross wing area 17.4 m.² (187.2 sq. ft.).

Fuselage.—All-metal semi-monocoque structure.

Tail Unit.—Cantilever monoplane type. All-metal structure. Single spar tailplane, two-spar fin.

Landing Gear.—Retractable tricycle type. Hydraulic retraction. Hydraulic shock-absorbers. Wheel-base 2.537 m. (8 ft. 4 in.). Track of main wheels 3.10 m. (10 ft. 2 in.).

Power Plant.—Two Turbomecà Marboré II turbojet engines (400 kg. = 880 lb. s.t. each) fuselage with air inlet in nose and jet exits below trailing-edge of wing roots. Two fuel tanks in fuselage and two in wings. Total internal fuel capacity 745 litres (164 Imp. gallons). Two wing tip tanks 240 litres (53 Imp. gallons) capacity each.

Accommodation.—Enclosed cabin seating two in tandem with dual controls.

Equipment.—Complete blind-flying instrument equipment, VHF, radio compass, ILS, oxygen, etc. Armament appropriate to various training functions may be fitted.

Dimensions.—
- Span 10.42 m. (34 ft. 2 in.).
- Length 8.88 m. (29 ft. 1½ in.).
- Height 2.85 m. (9 ft. 4 in.).

Weights (Designed).—
- Weight empty 1,446 kg. (3,181 lb.).
- Useful load 502 kg. (1,104 lb.).
- Disposable load 1,766 kg. (3,885 lb.).
- Weight loaded 3,212 kg. (7,066 lb.).

Performance (Estimated).—
- Max. speed at S/L. 652 km.h. (405 m.p.h.).
- Max. speed at 9,000 m. (29,520 ft.) 710 km.h. (441 m.p.h.).
- Initial rate of climb 816 m./min. (2,676 ft./min.).
- Climb to 3,000 m. (9,840 ft.) 4 min.
- Service ceiling 12,000 m. (39,360 ft.).
- Max. Cruising duration 4.7 hours.
- Cruising range 1,700 km. (1,056 miles) at 10,000 m. (32,800 ft.).

An impression of the Hispano HA-200-RI Jet Conversion Trainer.

SWEDEN

SAAB

SVENSKA AEROPLAN A.B. (SAAB AIRCRAFT COMPANY).
HEAD OFFICE : LINKÖPING.
WORKS : LINKÖPING, JÖNKÖPING, TROLLHÄTTAN AND GOTHENBURG.
President : Tryggve Holm.

LINKÖPING DIVISION (SAAB-L).
Vice-President, Aeronautical Engineering : L. Brising.
Vice-President, Production : B. Johnson.
Vice-President, Finance : T. Arnheim.
Sales Manager : A. Rydberg.
Manager, Technical Service Department : C. Larsson.
Manager, Purchasing Department : U. Rydberg.

JÖNKÖPING DIVISION (SAAB-J).
(Aircraft apparatus and equipment)
Vice-President in charge : T. Faxén.

TROLLHÄTTAN DIVISION (SAAB-T).
(Motorcars, etc.)
Vice-President in charge : Svante Holm.

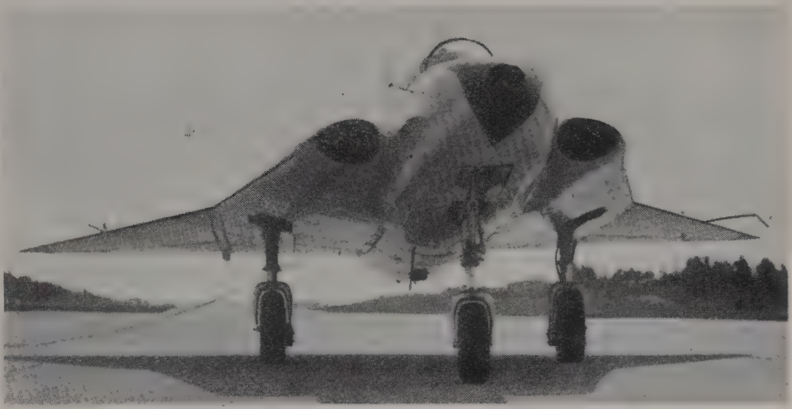
The Saab Aircraft Company was founded at Trollhättan in 1937 for development and production of all-metal military aircraft. In 1939 Saab took over the Aircraft Division (ASJA) of the Svenska Järnvägsverkstäderna rolling stock factory in Linköping, which had been manufacturing and developing military and civil aircraft since 1930. In connection with the merger, Saab moved its head office and engineering departments to Linköping which has since become the company's main factory. In 1950, the company acquired a factory at Jönköping for development and manufacture of aircraft and related equipment. Other post-war expansions include a bomb-proof underground factory in Linköping, as well as important new production and engineering facilities in Linköping, Jönköping, Trollhättan and Gothenburg, which latter factory is producing components for the motor-car production at Trollhättan, began in 1949-50, and which is now on a major scale.

The capital of the company has been successively increased in connection with the large expansions that have taken place over the years, and now stands at Kr. 31,000,000. The four Saab factories to-day employ approximately 6,000 people.

During World War II, the company supplied the Royal Swedish Air Force with large numbers of Saab-designed light bombers and fighters. The first Swedish-designed jet fighter, the Saab-21R, made its first flight in March, 1947. A jet-propelled development of the previous pusher-propelled Saab-21A fighter and attack aircraft, the Saab-21R was the only aircraft converted from piston engine to jet propulsion that has been produced in quantity. In September, 1948, the first prototype of a swept-wing jet fighter, the Saab-29, made its maiden flight. The Saab-29 was the first-swept-wing jet fighter to go into large-scale production and service in Western Europe and deliveries began in May, 1951.

The company is currently producing the Saab-32 Lansen, a two-seat transonic all-weather combat aircraft, as well as advanced versions of the versatile Saab-29 day fighter, ground attack and photographic reconnaissance aircraft, which has been produced in far greater numbers than any other Swedish aircraft. It has also been disclosed that Saab is working on still-secret projects for the Royal Swedish Air Force.

In the civil field, the company has designed and built the Saab-90 Scandia twin-engined 32-passenger airliner and the Saab-91 Safir three or four-seat training and touring aircraft.



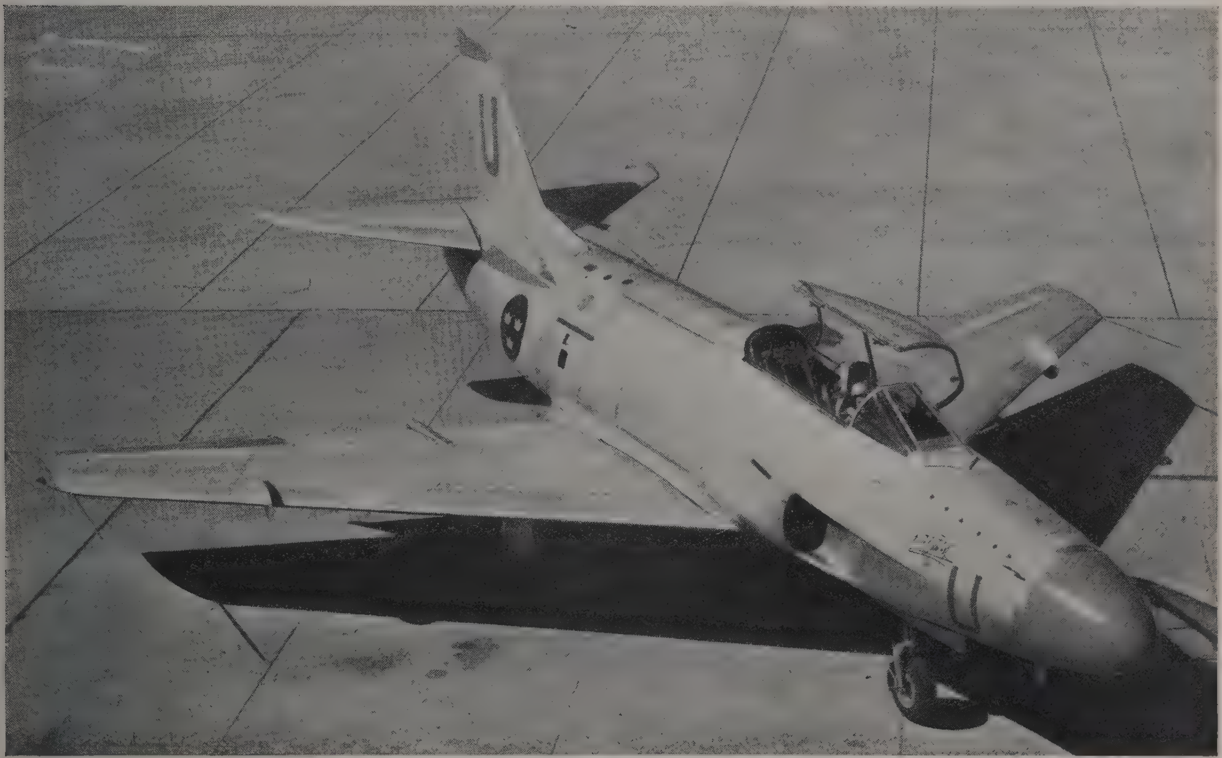
The Saab-210 Draken Tail-less Research Monoplane.

THE SAAB-210 DRAKEN.

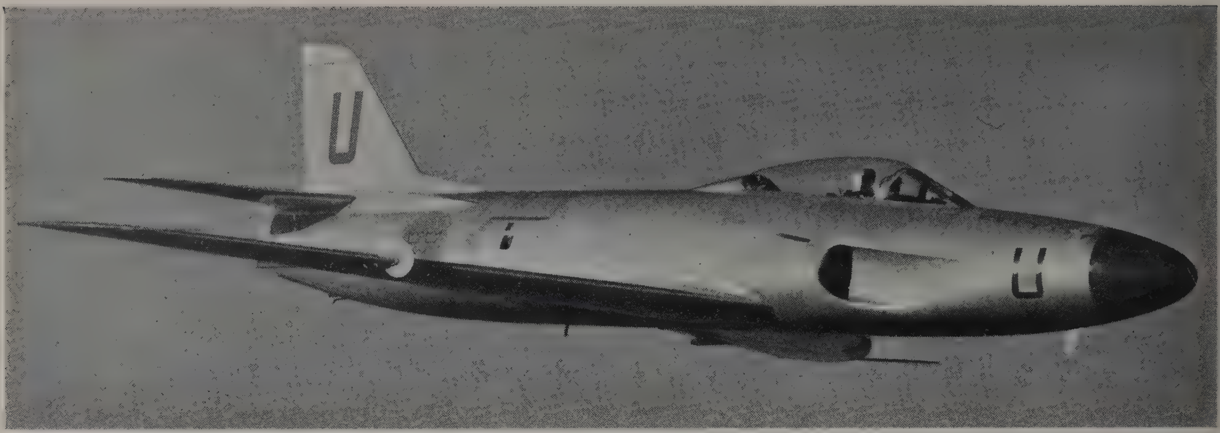
The Saab-210 is a small unconventional single-seat tail-less research aircraft which has been built expressly for the testing of an unusual wing configuration at subsonic speeds. The wing, which has an extremely low aspect ratio, has a plan form made up of two triangles, or what might be described as a "double-delta" form.

There is no conventional stabiliser. Elevator control is combined with the ailerons, the "elevons" being operated by a hydraulic booster system of Saab design.

Other design features include a retractable nose-wheel landing-gear, the main units of which may, for test purposes, be moved forward or backward by making



The Saab-32 Lansen Two-seat All-weather Fighter (Rolls-Royce Avon turbojet engine).



The prototype Saab-32 Lansen Two-seat All-weather Fighter (Rolls-Royce Avon turbojet engine).

only a few simple changes. Further, the C.G. may be varied in flight by pumping liquid between trim tanks in the nose and tail.

The aircraft is fitted with a wide range of measuring equipment, including an automatic camera for photographing of instruments, and an oscillograph to register rudder forces, flight paths, etc.

Equipment includes a drag parachute and a Saab ejector-seat.

The Saab-210 which is powered by an Armstrong Siddeley Adder axial-flow turbojet engine (475 kg.=1,050 lb. s.t.), made its first flight in December, 1951.

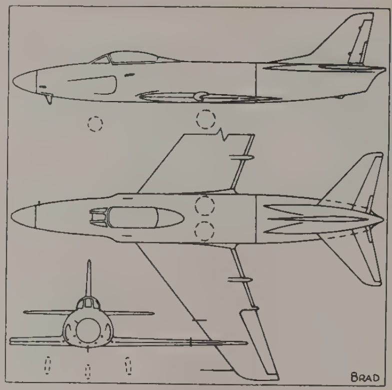
THE SAAB-32 LANSEN.

Royal Swedish Air Force designation: A 32A.

The Saab-32 was designed and built for the Royal Swedish Air Force in accordance with a specification laid down by the Royal Swedish Air Board for an aircraft primarily intended for all-weather attack operations against ground and sea targets.

The first prototype of the Saab-32 made its first flight on November 3, 1952, powered by an early version of the British-built Rolls-Royce Avon axial-flow turbojet engine. The production A 32A, however is fitted with the Avon RA.7 with afterburner (Swedish Air Force designation RM 5) built under licence in Sweden by Svenska Flygmotor AB. of Trollhättan.

During 1953 a Lansen prototype exceeded the speed of sound under complete control during dive tests, one of the first aircraft of its class in the World to do so.



The Saab-32 Lansen.

The Lansen was ordered into quantity production in 1953, and large-scale production is now under way with the A 32A all-weather attack version. It has been disclosed that later versions of the Lansen will be built for all-weather interception and reconnaissance. A two-seat dual-control trainer is also being developed.

Type.—Two-seat All-weather Attack Fighter.

Wings.—Swept low-wing cantilever monoplane with 35° sweep-back at 25% wing chord. Thin laminar-flow wing section. Aspect ratio 4.5. All-metal flush-riveted stressed skin structure. Ailerons operated by hydraulic booster system of Saab design. Fowler flaps. Automatic leading-edge slats on first prototype now replaced by stall fences.

Fuselage.—All-metal structure with flush-riveted stressed skin. Entire rear fuselage quickly removable for access to engine. Four air-brakes in rear fuselage sides.

Tail Unit.—Cantilever monoplane type. Movable tailplane mounted on big fairings used to smooth the airflow around the tailplane. Elevator operated by hydraulic booster system.

Landing Gear.—Retractable nose-wheel type. Hydraulically (Saab) retractable, main wheels into the fuselage, the nose wheel forwards. Dunlop wheels and Maxaret anti-skid brakes.

Power Plant.—One Svenska Flygmotor-built Rolls-Royce Avon RA.7 (Swedish designation RM 5) axial-flow turbojet engine with re-heat installation. Air intakes in fuselage sides.

Accommodation.—Pressurized cockpit for pilot and observer. Ejector seats of Saab design. The aircraft may be equipped with dual control to facilitate crew training.

Armament.—Cannon, bombs and rocket projectiles. The aircraft can also carry guided missiles.

Dimensions.—
Span 13 m. (42 ft. 8 in.).
Length 15 m. (49 ft. 2 in.).
Height 5 m. (16 ft. 5 in.).

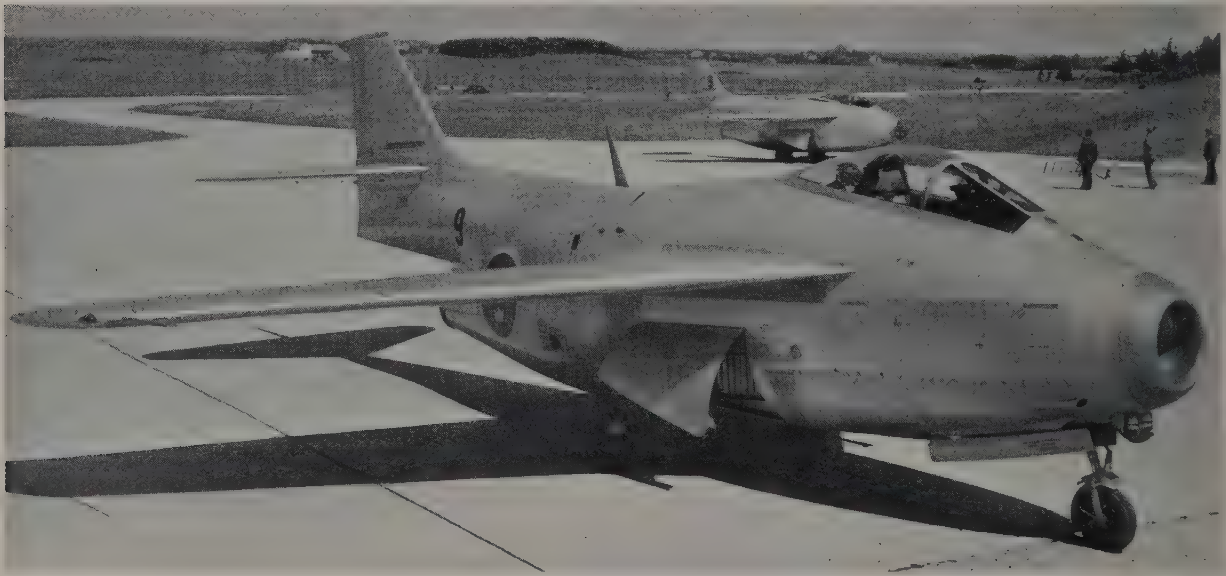
Weights.—
Weight loaded approx. 10,000 kg. (22,000 lb.).

Performance.—
Max. speed over 1,100 km.h. (700 m.p.h.).

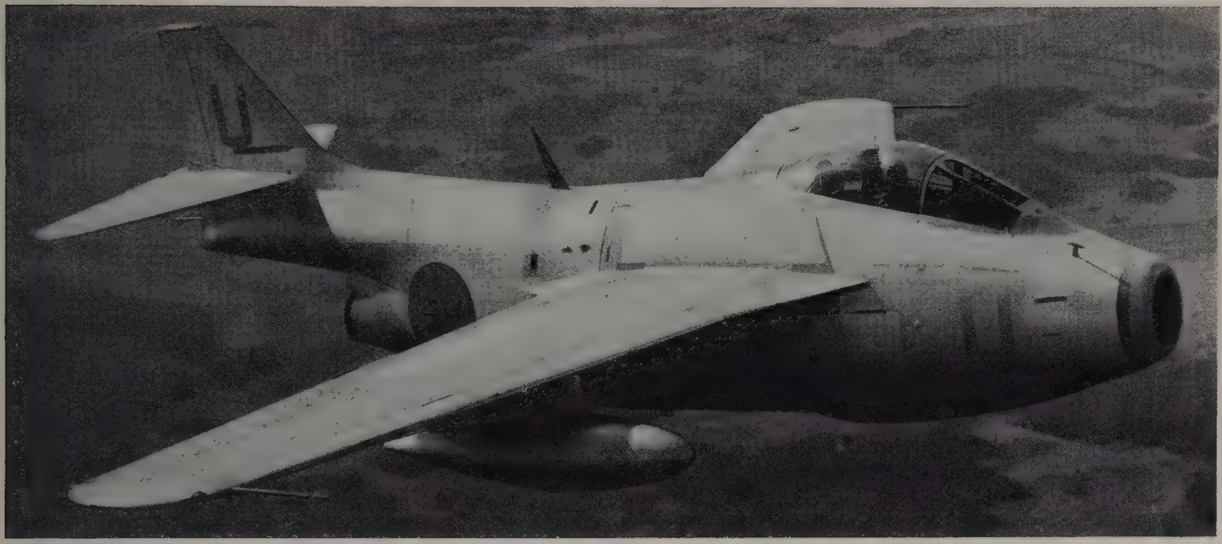
THE SAAB-29.

Royal Swedish Air Force designations: J 29, A 29 and S 29.

The Saab-29 was the first swept-wing jet fighter to be put into large-scale production in Western Europe. The first of three prototypes was test-flown on September 1, 1948, powered by a D.H. Ghost turbojet engine giving a



The Saab-29 (J 29) Single-seat Interceptor Fighter (Svenska Flygmotor Ghost turbojet engine).



The Saab-29 (S 29) Single-seat Photographic Reconnaissance Monoplane (Svenska Flygmotor Ghost turbojet engine).

static thrust of about 4,400 lb. (2,000 kg.). A series prototype made its first flight in July, 1950. All production aircraft are fitted with 5,000 lb. (2,270 kg.) static thrust Ghost engines built under licence in Sweden by Svenska Flygmotor AB (SFA) at Trollhättan. The Saab-29F version is also fitted with a Swedish-developed afterburner.

On May 6, 1954, Saab-29B (J 29B) piloted by Captain A. E. Westerlund set up an international speed record averaging 975.916 km.h. (607.05 m.p.h.) over a 500-km. closed circuit distance, and on March 23, 1955, two Saab-29C (S 29C) photographic reconnaissance aircraft piloted by Captain Hans Neij and short-service pilot Birger Eriksson established a new international speed record, flying a 1,000-km. closed circuit distance with an average speed of 900.6 km.h. (560 m.p.h.).

The Saab-29 series of day fighter, attack and photographic reconnaissance aircraft is in large-scale service with the Royal Swedish Air Force, and the following principal versions have been produced in quantity (only A.F. designations are used) :—

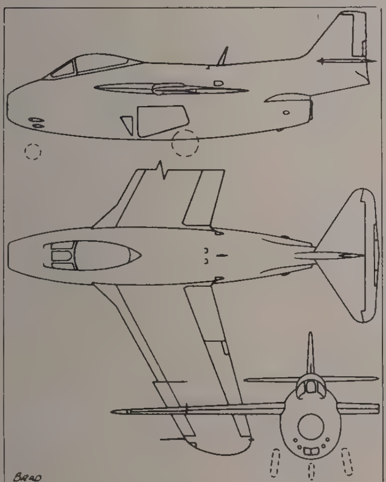
J 29A. First production version. Initial aircraft featured wing air brakes, later aircraft fuselage-mounted air brakes. Deliveries started in May, 1951.

J 29B. Second production version with increased internal fuel tankage. Replaced the J 29A in production early in 1953.

A 29. Attack version identical to the J 29B.

S 29C. Photographic reconnaissance version carrying up to six fully automatic cameras and improved navigation equipment. The prototype made its first flight in June, 1953. Deliveries started before the end of 1953 and are still continuing.

J 29F. The fourth production version. The J 29F combines the improvements of the J 29E, an experimental variant first flown in December, 1953, with a modified outer wing giving higher critical Mach. number and improved transonic flight characteristics, and the J 29D experimental version, first flown in March, 1954, equipped with a Swedish afterburner developed by the Royal Swedish Air Board and Svenska Flygmotor AB in collaboration. The introduction of an afterburner has approximately doubled the climb rate of the aircraft and considerably increased the service ceiling. The first pre-production J 29F made its first flight in the late summer of 1954. A considerable number of J 29B fighters will be brought up to J 29F standard. Deliveries of the J 29F started late in 1954.



The Saab-29 (J 29F).

The description below refers to the J 29B in general :—

Type.—Single-seat jet-propelled Interceptor (J 29), Ground Attack Fighter (A 29) and Photographic Reconnaissance monoplane (S 29).

Wings.—Swept shoulder-wing cantilever monoplane with 25° sweep-back. Thin laminar-flow wing section. All-metal two-spar structure with flush-riveted stressed skin, partly of 75S alloy. Automatic leading-edge slots are light alloy castings. They are locked in closed position when landing flaps are up. Ailerons operated by hydraulic booster system of Saab design. Air brakes in the initial series were fitted to the wing behind the rear spar, but are fuselage-mounted in later aircraft. Gross wing area 258 sq. ft. (24.0 m.^{2}).

Fuselage.—All-metal structure with flush-riveted stressed skin. Built in three sections. The straight central air duct is integral and stress-taking. Of generous cross-section, the fuselage houses the engine, landing-gear, fuel tanks, armament, etc.

Tail Unit.—Cantilever monoplane type. High-mounted tailplane is electrically adjustable in flight. Maximum angles +1°/—6°. The operating switch is on the pilot's stick. Two different setting speeds are available, the lower one for high-speed trimming giving a change in tailplane setting of about 1°/sec. The elevator has a mechanically operated trim-tab as an emergency precaution.

Landing Gear.—Retractable tricycle type. Hydraulically retracted, main wheels forward, nosewheel backwards, into the fuselage. Goodyear single-disc brakes. Designed for operation on grass airfields. Track 7 ft. 2 in. (2.2 m.).

Power Plant.—One Svenska Flygmotor (D.H. licence) Ghost 50 (Swedish Air Force designation : RM2) turbojet engine rated at 5,000 lb. (2,300 kg.) at 10,250 r.p.m. Engine mounted at three points on a strong fuselage frame. Engine cowling stressed for tail loads, removable in one piece. Afterburner fitted in J 29F version.

Accommodation.—Pressurised pilot's cockpit ahead of wing leading-edge. Bullet-proof wind shield and sliding canopy, the latter jettisonable with gunpowder charge. Marshall cabin blower. Pilot's ejector seat of Saab design.

Armament.—Four 20 mm. cannon and an undisclosed number of rockets.

Dimensions.—
- Span 36 ft. 1 in. (11.0 m.).
- Length 33 ft. 2½ in. (10.13 m.).
- Height 12 ft. 3½ in. (3.75 m.).

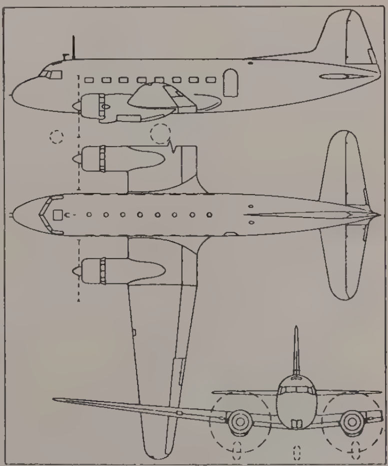
Weights and Loading.—
- Operating weight empty 4,300 kg. (9,479 lb.).
- Normal take-off weight 6,060 kg. (13,360 lb.).
- Wing loading 252 kg./m.^{2} (51.6 lb./sq. ft.).

Performance.—
- Max. speed 1,060 km.h. (658 m.p.h.).
- Max. range 2,700 km. (1,677 miles).
- Take-off run to 15 m. (50 ft.) normal T.O. weight 900 m. (984 yds.).
- Landing run from 15 m. (50 ft.) with flaps down (landing weight 4,600 kg. (10,120 lb.) 900 m. (984 yds.).

THE SAAB-90 A-2 SCANDIA.

The Scandia was originally conceived in 1944 and made its first flight on November 16, 1946.

The Scandinavian Airlines System (SAS) is operating a fleet of Scandias on its European routes and the Scandia is also in service with the Brazilian VASP airline company. Additional aircraft have been assembled under Saab sub-contract by the Dutch Fokker company for both SAS and VASP.



The Saab-90 A-2 Scandia Airliner.

The Saab-90 A-2 Scandia Airliner (two 1,400 h.p. Pratt & Whitney R-2180 engines).

TYPE.—Twin-engined Airliner.

WINGS.—All-metal cantilever low-wing monoplane. Wing consists of constant-chord centre-section carrying engine nacelles, and two tapered outer sections. Stressed-skin construction. Dihedral from roots. Aspect ratio 9.15. Gross wing area 922 sq. ft. (85.7 m.²). Metal ailerons with trim-tab in port aileron. Aileron area (each) 34.7 sq. ft. (3.2 m.²). Slotted trailing-edge flaps extend under fuselage between ailerons. Total flap area 166.78 sq. ft. (15.50 m.²).

FUSELAGE.—All-metal monocoque structure of stressed skin construction.

TAIL UNIT.—Cantilever type. Trim-tabs in elevators and rudder. Tailplane span 31 ft. 8 in. (9.65 m.). Tailplane area 209.9 sq. ft. (19.5 m.²).

LANDING GEAR.—Retractable tricycle type, all wheels retracting forward, main wheels into nacelles and nose-wheel into fuselage. Hydraulic operation. Wheel track 22 ft. 10 in. (6.96 m.), wheel-base 19 ft. 5 in. (5.93 m.).

POWER PLANT.—Two Pratt & Whitney R-2180 E1 Twin-Wasp fourteen-cylinder radial air-cooled engines, each rated at 1,400 b.h.p. at 2,700 r.p.m. at 7,000 ft. (2,135 m.) and with 1,800 b.h.p. at 2,800 r.p.m. with water-injection available for take-off. Four-blade airscrews. Fuel tanks are in outer wings with consumable capacity of 638 Imp. gallons (2,900 litres). Tanks can be installed having a consumable capacity of 750 Imp. gallons (3,400 litres). Oil capacity 46 Imp. gallons (210 litres).

ACCOMMODATION.—Crew of four consisting of pilot, co-pilot, radio-operator and steward. In addition there is a seat for a flight-mechanic in the crew compartment. Aft of crew compartment is main passenger cabin with 24 seats arranged with 8 double seats on the starboard side and 8 single seats on the port side or, alternatively, 32 seats arranged in 8 slightly-staggered double seats on each side of the central aisle. Fastenings for the two sets of seats are identical in each case, and change-overs can be effected in about half an hour. Entry door on port side, main door sill 7 ft. 7 in. (2.3 m.) above ground. Aft of main cabin is the galley (on starboard side) with door to cargo compartment, and lavatory (on port side). Main cargo compartment of 225 cub. ft. (6.4 m.³) capacity is aft. Nose cargo compartment has a capacity of 11 cub. ft. (0.3 m.³) forward belly cargo compartment 80 cub. ft. (2.3 m.³) and rear belly cargo compartment 70 cub. ft. (2.0 m.³). Loading doors are on upper side of the nose (nose cargo compartment) and on starboard side (other compartments). Total cargo capacity 386 cub. ft. (11 m.³).

DIMENSIONS.—
Span 91 ft. 10 in. (28.0 m.).
Length 69 ft. 11 in. (21.3 m.).
Height 23 ft. 3 in. (7.08 m.).

WEIGHTS AND LOADINGS.—
Manufacturer's weight empty 21,960 lb. (9,960 kg.).
Max. take-off weight 35,280 lb. (16,000 kg.).
Wing loading 38 lb./sq. ft. (185 kg./m.²).
Power loading 9.8 lb./h.p. (4.5 kg./h.p.).

PERFORMANCE.—
Max. speed 280 m.p.h. (450 km.h.) at 8,500 ft. (2,590 m.).
Cruising speed 242 m.p.h. (391 km.h.) at 10,000 ft. (3,050 m.).
Stalling speed (flaps down) 80 m.p.h. (130 km.h.).
Initial rate of climb 1,350 ft./min. (410 m./min.) at max. T.O. weight.
Service ceiling 22,850 ft. (7,500 m.).
On one engine (ICAO) 7,135 ft. 2,400 (m.).
Max. range 1,560 miles (2,510 km.) at 10,000 ft. (3,050 m.).
Take-off distance to 50 ft. (15.21 m.) 2,700 ft. (825 m.).
Landing distance from 50 ft. (15.21 m.) 1,850 ft. (565 m.).
Single engine take-off distance (ICAO) 3,940 ft. (1,200 m.).

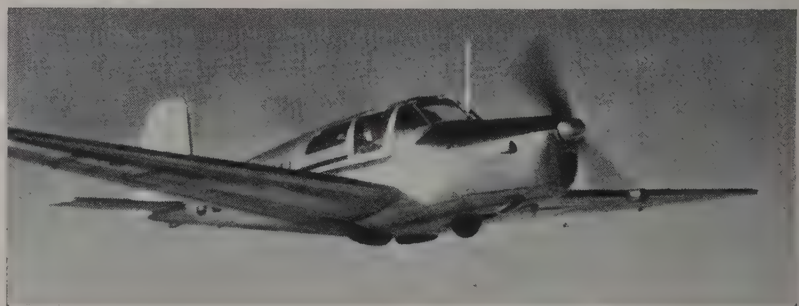
THE SAAB-91A SAFIR.

The Safir, which first flew in 1945, was originally fitted with a 130 h.p. D.H. Gipsy Major IC engine. The production model, however, is powered with a later model D.H. Gipsy Major 10 of 145 h.p. Apart from being marketed in Sweden, the Safir has been exported to various parts of the World—Argentina, Brazil, Ethiopia, Holland, India, etc.

Experimental variants of the Safir have been fitted with swept wings for research purposes.

TYPE.—Three-seat Low-wing Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Single-spar structure in two detachable sections bolted to fuselage. Metal covering in front of spar and fabric aft. Aspect ratio 8.3; taper ratio 1 : 0.45. Wing area 146.3 sq. ft. (13.60 m.²). Ailerons have Alclad-structure with fabric covering. Trim-tab in port aileron adjustable on ground. Mechanically-operated all-metal split trailing-edge flaps between ailerons and fuselage.



The Saab-91 Safir (145 h.p. D.H. Gipsy Major 10 engine).

FUSELAGE.—Monocoque structure with vertical frames, longitudinal stringers and stressed Alclad skin.

TAIL UNIT.—Cantilever monoplane type. Alclad structure with metal skin over fixed surfaces and fabric covering to rudder and elevators. Controllable trim-tab in starboard elevator and adjustable balance tab in rudder.

LANDING GEAR.—Retractable tricycle-type. Main wheels, carried on oleo-spring shock-absorber legs, retract inwards into fuselage, and nose-wheel backwards into fuselage. Mechanical operation. Hydraulically-operated wheel-brakes controlled by toe-pedals.

POWER PLANT.—One 145 b.h.p. D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engine driving two-blade airscrew. Fuel capacity 24 Imp. gallons (110 litres) with 5.5 Imp. gallons (25 litres) reserve.

ACCOMMODATION.—Enclosed cabin seating three, pilot (on port) and one passenger side-by-side in front with dual control and second passenger behind and on starboard side, with luggage compartment behind pilot. Two passenger seats may be replaced by stretcher or freight. Three hinged panels for access, which can be jettisoned in emergency. Cabin interior width 4 ft. 0 in. (1.22 m.).

DIMENSIONS.—
Span 34 ft. 9 in. (10.60 m.).
Length 25 ft. 7 in. (7.8 m.).
Height 7 ft. 3 in. (2.20 m.).

The Saab-91B Safir Military Trainer (190 h.p. Lycoming engine).

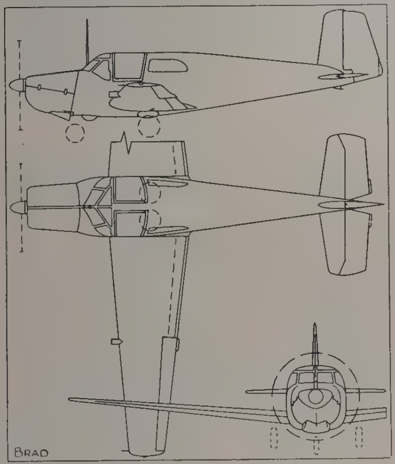
WEIGHTS AND LOADINGS.—
Weight empty 1,278-1,344 lb. (580-610 kg.) according to equipment.
Disposable load 849-915 lb. (385-415 kg.).
Weight loaded 2,195 lb. (955 kg.).
Max. overload 2,370 lb. (1,075 kg.).
Wing loading (at normal loaded weight) 15 lb./sq. ft. (73.2 kg./m.²).
Power loading 15.66 lb./h.p. (7.1 kg./h.p.).
PERFORMANCE.—
Max. speed 164 m.p.h. (265 km.h.).
Max. cruising speed 154 m.p.h. (248 km.h.).
Economical cruising speed 146 m.p.h. (235 km.h.).
Stalling speed 53 m.p.h. (85 km.h.).
Rate of climb at sea level 985 ft./min. (300 m./min.).
Cruising range 585 miles (960 km.).

THE SAAB-91B SAFIR.

Royal Swedish Air Force designation: Sk 50.

This version of the Safir differs from the 91A mainly in having a 190 h.p. Lycoming O-435-A engine. The first prototype made its maiden flight on January 18, 1949.

In 1951, the Royal Swedish Air Force adopted the Saab-91B as a standard primary trainer and a considerable number was ordered. Owing to Saab's other military commitments, the production of these aircraft was subcontracted to the Dutch De Schelde factory at Dordrecht. Following increased production capacity at Saab's main plant in Linköping, Safir production was resumed in Sweden at the end of 1954.



The Saab-91B Safir.

The Saab-91C Safir Four-seat Tourer (190 h.p. Lycoming engine).

The 91B may be equipped to carry two 8 mm. guns and eight 63 mm. rocket projectiles or training bombs. The Safir is now being used by several air forces, but has also attained a rather unique position as a trainer for the pilots of the following airlines—KLM, SABENA, Deutsche Lufthansa and Air France.

During 1954, the Swedish Air Force introduced a new training system under which pilots go direct from the Safir to an advanced jet trainer, at present the D.H. Vampire Trainer (J 28C).

POWER PLANT.—One 190 h.p. Lycoming O-435-A six-cylinder horizontally-opposed air-cooled engine driving a Hartzell two-blade variable-pitch airscrew. Petal-type cowling. Fuel capacity 175 litres (38.5 Imp. gallons).
DIMENSIONS.—
Span 34 ft. 9 in. (10.6 m.).
Length 26 ft. (7.95 m.).
Height on ground 7 ft. 2 in. 2.2 m.).
WEIGHTS AND LOADINGS.—
Weight empty 1,590 lb. (720 kg.).
Weight loaded (Utility category) 2,686 lb. (1,215 kg.).
Weight loaded (Acrobatic category) 2,320 lb. (1,050 kg.).
Wing loading (Aerobatic) 15.8 lb./sq. in. (77.2 kg./m.²).
Power loading (Aerobatic) 12.2 lb./h.p. (5.53 kg./h.p.).
PERFORMANCE.—
Max. speed 171 m.p.h. (275 km./hr.).
Max. cruising speed 152 m.p.h. (245 km./hr.)
Econ. cruising speed at S/L. 144 m.p.h. (232 km./hr.).
Rate of climb at S/L. 1,140 ft./min. (5.8 m./sec.).
Service ceiling 20,500 ft. (6,250 m.).
Cruising range 670 st. miles (1,075 km.).

THE SAAB-91C SAFIR.

In September, 1953, a third version of the Safir made its first flight. The new version, which was later put into quantity production, is designated the Saab-91C and differs mainly from the three-seat 91B version in having comfortable accommodation for four people and luggage.

In addition to its use as a private, business, taxi and aerial mapping aircraft the 91C version can easily accommodate a stretcher case and a medical attendant, and by removing the rear seats a quarter-ton of cargo can be carried. It is also suitable as a trainer.

POWER PLANT.—
Same as for the Saab-91B.
DIMENSIONS.—
Same as for the Saab-91B.
WEIGHTS AND LOADINGS.—
Weight empty 745 kg. (1,650 lb.).
Weight loaded 1,215 kg. (2,686 lb.).
Wing loading 89.3 kg./m.² (18.2 lb./sq. ft.).
Power loading 6.4 kg./h.p. (14.1 lb./h.p.).
PERFORMANCE.—
Max. speed 270 km.h. (168 m.p.h.).
Max. cruising speed 240 km.h. (150 m.p.h.).
Econ. cruising speed at S/L. 227 km.h. (141 m.p.h.).
Rate of climb at S/L. 4.25 m./sec. (840 ft./min.).
Service ceiling 5,100 m. (16,800 ft.).
Cruising range 960 km. (600 miles).

SWITZERLAND

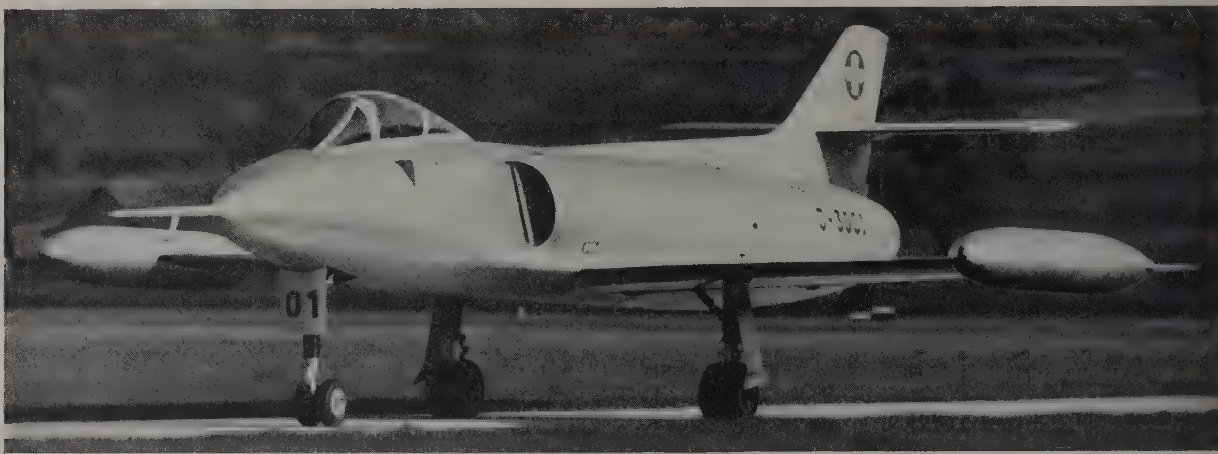
THE FEDERAL AIRCRAFT FACTORY

EIDG. FLUGZEUGWERK — FABRIQUE FEDERALE D'AVIONS (Federal Aircraft Factory).

Head Office and Works: Emmen, Lucerne.
Director: M. Buri.

This official Government establishment manufactures aircraft for the Swiss Army Air Corps. It is not in a position to provide details of its current activities.

FFA



The first prototype FFA P.16 Fighter Bomber (Armstrong Siddeley Sapphire turbojet engine).

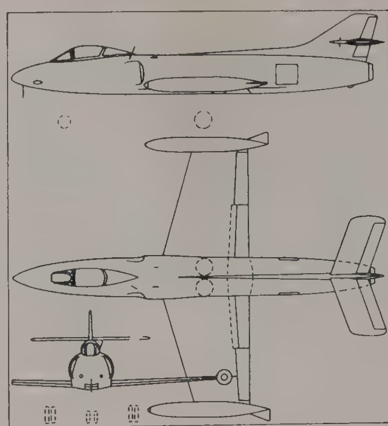
FLUG & FAHRZEUGWERKE A.G.

Head Office and Works: Altenrhein bei Rorschach.
President: Dr. Cl. Caroni.
Works Director: O. Eitel.
Chief Engineer, Aircraft Section: Dr. Ing. H. L. Studer.

This firm, formerly known as A.G. für Dornier-Flugzeuge was originally the Swiss branch of the German Dornier company. It is now entirely a Swiss company and builds aircraft for the Swiss Government only.

Between the years 1926 and 1937 it built mainly Dornier flying-boats, including the well-known Do X, the Dornier Wal, the Do 22 seaplane for Yugoslavia and the Do 24 flying-boat for the Netherlands. In 1937 a large number of Bücker 131 and 133 primary and aerobatic trainers were built under licence for the Swiss Air Force.

In 1939 the firm designed and built the Do 212 experimental four-seat amphibian flying-boat with submerged engine driving a propeller behind the tail by a drive shaft with cardan joints. This was the first aircraft with these features to fly (1941).



The P.16 Fighter Bomber.

In 1938-39 a series of D.3801 (Morane-Saulnier 406) and C.3603 (Swiss Federal Factory) were built under licence for the Swiss authorities and in 1943 the D.3802 single-seat fighter powered by a 1,250 h.p. Saurer YS 2 engine was developed. This aircraft flew 13 months after the mock-up stage.

Later the D.3803 was developed from the D.3802 and a small number was built for the Swiss Government. Production was abandoned in 1946 following the decision to adopt the D.H. Vampire as the standard Swiss Air Force fighter.

The company is now building Vampire and Venom wings and other components for the Swiss Government. It has completed the development and construction of a jet fighter of its own design known as the P.16, brief details of which follow.

THE P-16.

The P-16 single-jet fighter was designed for the Swiss Air Force according to a specification for a single-seat aircraft primarily intended for ground attack operations carried out from short runways situated in narrow valleys at considerable altitudes above sea-level. Therefore, apart from good high speed and climb performances, short landing and take-off

The first prototype FFA P.16 Fighter Bomber (Armstrong Siddeley Sapphire turbojet engine).

distances, as well as a small radius of turn together with good low-speed behaviour, were called for in the specification.

The first P-16 prototype, powered by an Armstrong Siddeley Sapphire turbojet, made its first flight April 28, 1955, and in preliminary trials it showed excellent flying qualities, especially in the low-speed range.

The wing has a moderate sweep and combines a low aspect ratio with a low thickness ratio. A system of efficient flaps is provided. Large wing-tip tanks, a retractable tricycle landing-gear with twin wheels on both main and nose-wheel units, a swept tailplane of constant chord and big nostril air intakes are further features of the P.16.

No further details and performance figures are yet available.

PILATUS

PILATUS FLUGZEUGWERKE A.G.

Head Office and Works: Stans, near Lucerne.

Managing Director: H. F. Alioth.

Chief Engineer: Dipl. Ing. H. Fierz.

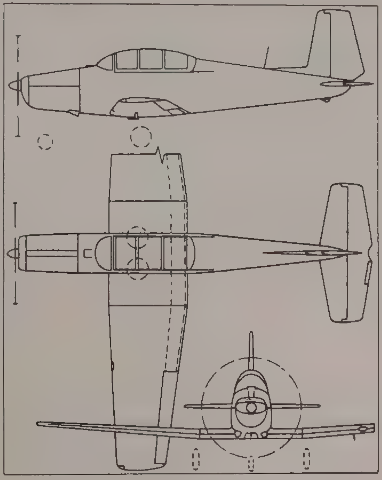
Pilatus Flugzeugwerke A. G. was formed in December, 1939, with a capital of two million Swiss francs and it began work in September, 1941. A founder's syndicate was formed in 1938 under the leadership of M. E. Bührle, the Swiss industrialist and owner of the Oerlikon Company, of which the Pilatus Company is now a subsidiary.

The first product of the company was the SB-2 Pelican, a four/six-seat cabin monoplane which was developed by the Swiss Aerotechnical Association at the Swiss Institute of Technology at Zürich in collaboration with the Pilatus company. The prototype was flown in 1944 and was later put into service by a Swiss air transport company.

Later productions were the P-2 advanced training monoplane, which was supplied in a small quantity to the Swiss Air Force, and the P-4 five-seat cabin monoplane.

The latest Pilatus product is the P-3 advanced training monoplane, the prototype of which made its first flight on September 3, 1953. It is described hereafter.

The Pilatus P-3 Two-seat Advanced Trainer (240 h.p. Lycoming engine).


The Pilatus P.3 Trainer.

THE PILATUS P-3.

Type.—Two-seat Advanced Trainer.

Wings.—Low-wing cantilever monoplane. NACA Series 64A wing section. Aspect ratio 6.55. Chord 1.9 m. (6 ft. 2¾ in.) at root, 1.14 m. (3 ft. 8¾ in.) at tip. Dihedral 3° on upper surface of wing. Incidence +1° at root, —1° at tip. Sweepback 1° at 25% of chord. Single-spar aluminium-alloy structure. Split flaps and ailerons of similar construction. Total area of ailerons 1.66 m.² (17.8 sq. ft.). Total area of flaps 2.03 m.² (21.8 sq. ft.). Gross wing area 16.55 m.² (178 sq. ft.).

Fuselage. — All - metal semi - monocoque structure.

Tail Unit.—Cantilever monoplane type. All-metal structure. Areas: fin 0.72 m.² (7.7 sq. ft.), rudder 0.73 m². (7.8 sq. ft.), tailplane 2.0 m.² (21.5 sq. ft.), elevators 1.25 m.² (13.4 sq. ft.). Span of tail 3.25 m. (10 ft. 8 in.).

Landing Gear.—Retractable tricycle type. Electro-mechanical retraction. Pilatus oil/steel spring shock-absorbers. Goodyear wheels and disc brakes. Wheelbase 2.37 m. (7 ft. 6 in.). Track of main wheels 2.62 m. (8 ft. 6 in.).

Power Plant.—One 240 h.p. Lycoming GO-435-C2 six-cylinder horizontally-opposed air-cooled engine. Hartzell constant-speed airscrew. Two fuel tanks in centre-section. Total fuel capacity 170 litres (37.3 Imp. gallons). Oil capacity 11.3 litres (2.4 Imp. gallons).

Accommodation.—Crew two in tandem with dual controls. One-piece sliding canopy. Adjustable seats. Fuel instrumentation for day and night flying. R/T transmitter and receiver.

Optional Equipment.—Provision for one machine-gun, two training rocket launchers, racks for two practice bombs, gun camera, oxygen equipment.

Dimensions.—
- Span 10.40 m. (34 ft. 1 in.).
- Length 8.75 m. (28 ft. 8 in.).
- Height 3.05 m. (10 ft.).

Weights.—
- Weight empty (with optional equipment) 1,050 kg. (2,310 lb.).
- Weight loaded 1,500 kg. (3,300 lb.).

Performance.—
- Max. speed from S/L. to 2,000 m. (6,560 ft.) 310 km.h. (192.5 m.p.h.).
- Max. cruising speed 270 km.h. (167.6 m.p.h.).
- Econ. cruising speed 255 km.h. (155 m.p.h.).
- Min. speed 100 km.h. (62 m.p.h.).
- Rate of climb at S/L. 420 m./min. (1,378 ft./min.).
- Rate of climb at 2,000 m. (6,560 ft.) 222 m./min. (722 ft./min.).
- Service ceiling 5,500 m. (18,040 ft.).
- Absolute ceiling 6,100 m. (20,000 ft.).
- Take-off distance to 15 m. (50 ft.) at S/L. on hard runway 340 m. (371 yds.).
- Landing distance from 15 m. (50 ft.) at S/L. on hard runway 380 m. (415 yds.).

TURKEY

M.K.E.K.

MAKINA VE KIMYA ENDUSTRISI KURUMU.

Head Office: M.K.E. Genel Müdürlük, Ankara.

Aircraft Engineering Division: M.K.E. Genel Müdürlük, Ankara.

Aircraft Factory: M.K.E. Ucak Fb., Etimesgut, Ankara.

General Manager, M.K.E.K.: Hulki Yanat, M.Sc. (Ae.E.).

Manager, Aircraft Factory: Orhan Olmez, M.Sc. (Ae.E.).

The Aircraft Factory of the M.K.E.K. was originally founded by the Turkish Air League (Turk Hava Kurumu) in 1941.

In 1952 the factory was taken over by the M.K.E.K., an official establishment which includes the principal branches of the mechanical and chemical industries in Turkey. Aircraft manufacture in Turkey is now being undertaken solely by this State organisation.

THE M.K.E.K. MODEL 3.

This will be a two-seat side-by-side primary trainer, all details of which are at present withheld.

THE M.K.E.K. MODEL 4 UGUR (LUCK).

The Model 4 is a military two-seat tandem primary trainer, which is in production for the Turkish Air Force. Examples have also been presented to the Arab Legion Air Force.

Type.—Two-seat Primary Trainer.

Wings.—Low-wing cantilever monoplane. Clark YH wing section. Aspect ratio 5.7. Mean aerodyanamic chord 1.674 m. (5 ft. 6 in.). Dihedral 7.5°. Incidence 2°. Two-spar wood structure with plywood coverings. Conventional all-wood split flaps and ailerons. Total area of flaps 1.1 $m.^2$ (11.8 sq. ft.). Total area of ailerons 1.36 $m.^2$ (14.6 sq. ft.). Gross wing area 15.9 $m.^2$ (171 sq. ft.).

Fuselage.—All-wood plywood-covered structure.

Tail Unit.—Cantilever monoplane type. Wood frames with plywood-covered fixed surfaces and fabric-covered rudder and elevators. Areas: fin 0.2 $m.^2$ (2.15 sq. ft.), rudder 0.9 $m.^2$ (9.6 sq. ft.), tailplane 1.7 $m.^2$ (18.3 sq. ft.), elevators 1.1 $m.^2$ (11.8 sq. ft.). Span of tail 2.7 m. (8 ft. 10 in.).

Landing Gear.—Fixed type. Dowty liquid-spring shock-absorbers. Goodyear wheels and hydraulic brakes. Track 2.25 m. (7 ft. 4½in.).

Power Plant.—One 145 h.p. Turkish-built D.H. Gipsy-Major four-cylinder inverted air-cooled engine. Fairy-Reed fixed-pitch metal airscrew. Fuel tanks in wings. Total internal fuel capacity 10 Imp. gallons (45 litres).

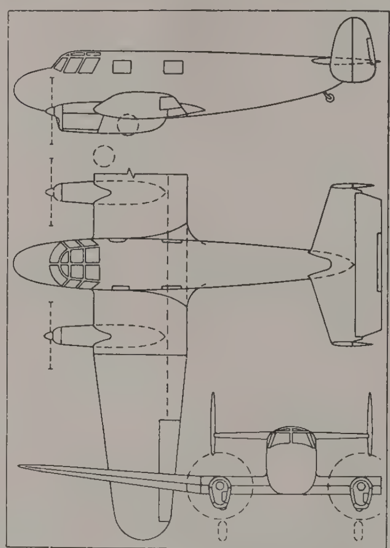
Accommodation.—Tandem cockpits under continuous transparent canopy. Dual controls. Adjustable seats.

Dimensions.—
Span 9.5 m. (31 ft. 2 in.).
Length 7.5 m. (24 ft. 7 in.).
Height 2.16 m. (7 ft.).

Two views of the M.K.E.K. Model 4 (145 h.p. D.H. Gipsy Major engine).

Weights.—
Weight loaded 923 kg. (2,030 lb.).

Performance.—
Max. speed at S/L. 216 km.h. (135 m.p.h.).
Cruising speed 192 km.h. (120 m.p.h.).
Stalling speed 72 km.h. (45 m.p.h.).
Initial rate of climb 244 m./min. (800 ft./min.).
Service ceiling 4,575 m. (15,000 ft.).
Normal range 512 km. (320 miles).
Take-off distance to clear 45 m. (150 ft.) 335 m. (366 yds.).
Landing distance from 45 m. (150 ft.) 366 m. (400 yds.).



The M.K.E.K. Model 5A Light Transport.

THE M.K.E.K. MODEL 5A (formerly THK-5A).

Type.—Twin-engine Light Transport.

Wings, Fuselage, Tail Unit, Landing Gear and Power Plant.—Same as for M.K.E.K. Model 5.

Accommodation.—Pilot and co-pilot side-by-side with dual controls in crew compartment, seats for four passengers in cabin. Large door on starboard side gives access to both crew compartment and cabin. Luggage compartment aft of cabin accessible from inside only. Cabin is soundproofed, heated and has individual ventilation for each passengers.

Dimensions, Weights and Performance.—Same as for M.K.E.K. Model 5.

The M.K.E.K. Model 5A Light Transport (two 130 h.p. D.H. Gipsy Major engines).

THE M.K.E.K. MODEL 5 (formerly THK-5).

Type.—Twin-engined Light Ambulance.

Wings.—Low-wing cantilever monoplane. NACA 23018-23012 wing section. Aspect ratio 7.65. Dihedral 7° Incidence 3°. Chord 2.50 m. (8 ft. 2½ in.) at root, 1.292 m. (4 ft. 3 in.) at tip. One-piece structure with two box spars, plywood ribs and plywood stressed-skin covering. Split-type all-wood ply-covered flaps. Differentially-operated all-wood ply-covered slotted ailerons. Fixed "letter-box" type slots in leading-edge of wing ahead of ailerons. Total flap area 1.436 $m.^2$ (15.4 sq. ft.). Total aileron area 2.80 $m.^2$ (30.1 sq. ft.). Gross wing area 28 $m.^2$ (300 sq. ft.).

Fuselage.—All-wood monocoque structure with vertical frames, longitudinal stringers and stressed plywood skin.

TAIL UNIT.—Cantilever monoplane type. Single-piece tailplane with twin fins and rudders as endplates. Tailplane has two-spar structure with plywood covering. Single-piece elevator has wood framework and fabric covering, and has controllable trim-tab in centre. Vertical surfaces are of wood with plywood covering for fins and fabric-covering for rudders. Trim-tab in port rudder adjustable from pilot's cockpit. Areas: fins 1.77 m.^{2} (19.0 sq. ft.), rudders 1.34 m.^{2} (14.4 sq. ft.), tailplane 3.10 m.^{2} (33.3 sq. ft.), elevator 2.14 m.^{2} (23.0 sq. ft.). Tailplane span 4.15 m. (13 ft. 7 in.).

LANDING GEAR.—Fixed tail-wheel type. Main wheels on J.A.R.U. oleo-pneumatic shock-absorber legs. Dunlop differentially-operated pneumatic wheel brakes. Oleo-sprung fully-castoring tail-wheel. Track 3.60 m. (11 ft. 9½ in.).

POWER PLANT.—Two 130 h.p. D.H. Gipsy Major four-cylinder in-line inverted air-cooled engines. Two-blade MKEK wood fixed-pitch aircrews. Two welded aluminium sheet fuel tanks in wings, one on each side of fuselage inboard of engine nacelles. Total fuel capacity 300 litres (66 Imp. gal.). Welded aluminium oil tank in each engine nacelle. Total oil capacity 20 litres (4.5 Imp. gal.).

ACCOMMODATION.—Enclosed accommodation for pilot and co-pilot side-by-side with dual controls. Door to flight compartment on starboard side. Cabin takes one or five stretchers, with seat for medical attendant. Large door on starboard side for loading stretchers. Main cabin sound-proofed, cockpit and cabin heated separately. Individual ventilating arrangements.

DIMENSIONS.—
Span 14.64 m. (48 ft.).
Length 10 m. (32 ft. 9½ in.).
Height 3.10 m. (10 ft. 2 in.).

WEIGHTS.—
Weight empty 1,450 kg. (3,190 lb.).
Weight loaded 1,900 kg. (4,180 lb.).

PERFORMANCE.—
Max. speed at S/L. 205 km.h. (127 m.p.h.).
Cruising speed 160 km.h. (99 m.p.h.).
Min. speed (with flaps) 100 km.h. (62 m.p.h.).
Initial rate of climb 192 m./min. (630 ft./min.).
Service ceiling 4,000 m. (13,120 ft.).
Range 650 km. (405 miles).
Take-off run 210 m. (230 yds.).
Landing run 195 m. (213 yds.).

THE M.K.E.K. MODEL 6
(formerly THK-14).

The M.K.E.K. Model 6 is a two-seat, high-wing training sailplane. It has a wooden monocoque fuselage of circular cross-section and the wing is a wooden single-spar structure with constant taper in chord and thickness. The tail-unit is a cantilever monoplane structure and the landing-gear consists of a skid under the fuselage and a single wheel. An enclosed cabin in the nose accommodates the crew of two side-by-side.

DIMENSIONS.—
Span 16 m. (52 ft. 6 in.).
Length 7.9 m. (25 ft. 11 in.).
Wing area 22.83 m.^{2} (245 sq. ft.).
Aspect ratio 11.2

WEIGHT AND LOADING.—
Weight empty 260 kg. (572 lb.)
Weight loaded 420 kg. (930 lb.).
Wing loading 18.4 kg./m.^{2} (3.77 lb./sq. ft.).

PERFORMANCE.—
Max. gliding speed 181 km.h. (112 m.p.h.).
Min. speed 53.5 km.h. (33.2 m.p.h.).
Max. permissible diving speed 502 km.h. (312 m.p.h.).


The M.K.E.K. Model 7 Single-seat Trainer (130 h.p. D.H. Gipsy Major engine).

THE M.K.E.K. MODEL 7
(formerly THK-2).

TYPE.—Single-seat Aerobatic Trainer.

WINGS.—Low-wing cantilever monoplane. NACA2412 wing section. Aspect ratio 6.4. Wings of elliptical plan form. Wood single spar structure with a plywood leading-edge forming a D-shaped torsional box member. Hand-operated split metal flaps. Ailerons have fabric-covered wood frames. Total area of flaps 0.93 m.^{2} (10 sq. ft.). Total area of ailerons 1.386 m.^{2} (14.9 sq. ft.). Gross wing area 10.4 m.^{2} (112 sq. ft.).

FUSELAGE.—Wooden monocoque structure with plywood skin.

TAIL UNIT.—Cantilever monoplane type. All-wood framework with plywood-covered tailplane and fin and fabric-covered rudder and elevators. Adjustable trim-tab in elevator controlled from pilot's cockpit. Areas: fin 0.40 m.^{2} (4.3 sq. ft.), rudder 0.60 m.^{2} (6.45 sq. ft.), tailplane 0.85 m.^{2} (9.1 sq. ft.), elevators 0.78 m.^{2} (8.4 sq. ft.). Tailplane span 2.50 m. (8 ft. 2½ in.).

LANDING GEAR.—Retractable type. Wheels raised backwards, turning through 90 degrees to lie flat in the wing when raised. Oleo shock-absorbers. Hand retraction. Swivelling tail-wheel fitted with compression rubber shock-absorber. Track 1.50 m. (4 ft. 11 in.).

POWER PLANT.—One 130 h.p. D.H. Gipsy Major four-cylinder inverted air-cooled engine. M.K.E.K. two-blade wood airscrew. Fuel tank in fuselage between engine and cockpit. Fuel capacity 70 litres (15.4 Imp. gal.).

ACCOMMODATION.—Enclosed cockpit with sliding canopy. Conventional controls and instrument equipment.

DIMENSIONS.—
Span 8.0 m. (26 ft. 3 in.).
Length 7.20 m. (23 ft. 7 in.).
Height 2.08 m. (6 ft. 10 in.).

WEIGHTS.—
Weight empty (with equipment) 497.5 kg. (1,095 lb.).
Weight loaded 657 kg. (1,443 lb.).

PERFORMANCE.—
Max. speed at sea level 260 km.h. (164.5 m.p.h.).
Cruising speed (60% power) 220 km.h. (136.4 m.p.h.).
Min. speed 81 km.h. (50 m.p.h.).
Initial rate of climb 290 m./min. (950 ft./min.).
Service ceiling 4,800 m. (15,745 ft.).
Range in still air 650 km. (405 miles).
Take-off run 154 m. (168 yds.).
Landing run 135 m. (147 yds.).

THE UNITED STATES OF AMERICA

THE DESIGNATION OF AMERICAN SERVICE AIRCRAFT.

The U.S. Air Force and U.S. Navy at present use separate and distinctive systems to designate their aircraft. The two schemes currently in use are described below.

The U.S. Air Force.

Aircraft of the U.S.A.F. are identified by a system in which the function of the aircraft is shown by letters.

B Bomber
C Cargo and Transport
F Fighter
H Helicopter
L Liaison
Q Target and Drone
R Reconnaissance
S Search and Rescue
T Trainer
X Special Research

These symbols are used either singly or, where an aircraft fulfils more than one function, in combination (*i.e.* TF, Fighter-Trainer, RB, Reconnaissance-Bomber, etc.), the symbols being followed by a number to indicate the model, the numbers running consecutively throughout the class or function irrespective of manufacturer. The letter A, for amphibian, is used in conjunction with other functional letters (*i.e.* SA, Search-Amphibian), but never alone.

Model changes are indicated by letters immediately following the basic model number (*i.e.* F-86A, F-86E, etc.). These qualifying letters usually indicate changes in power-plant, structure and/or equipment which affect interchangeability of parts and components, maintenance or tactical use.

The prefixes X, to indicate prototype ; Y, limited procurement for service trials ; and Z, obsolete ; are still used.

U.S. Naval Aviation.

U.S. Naval aircraft are designated by a system which incorporates letters to define the function and identify the manufacturer of the aircraft, and numbers to indicate the model and modifications of the model.

The functions of fixed-wing piloted aircraft are covered by the following letters :—

A Attack
F Fighter
O Observation
P Patrol
R Transport
S Anti-submarine
T Trainer
U Utility
V Convertiplane
W Special Search

Helicopters have the Symbol H with additional qualifying functional letters, thus :—

HH Search and Rescue
HO Observation
HT Training
HR Transport
HS Anti-submarine
HU Utility

A series of suffix letters to follow the model number is also used to indicate special modifications or specially-equipped versions of otherwise standard types. These are as follow :—

A Amphibian
B Special Armament
C Carrier conversion of non-carrier type
D Drone Control
E Special Electronic Gear
G Search and Rescue
H Ambulance
J Target Tug
K Target Drone
L Searchlight
M Weather Reconnaissance
N Night-operating aircraft
P Photo-Reconnaissance
Q Counter-measures Aircraft
R Transport
S Anti-submarine Warfare equipment
T Training
U Utility
W Special Search
Z Administrative.

The individual aircraft designations are made up of the functional letter, a model number, the manufacturer's letter and following a hyphen, a modification or mark number. For example, AD-1 broken down to its component symbols indicates that the aircraft is an Attack type (A) built by Douglas (D) and that it is the first (-1) variation or mark of the basic type. Developments of this aircraft are the AD-2, AD-3 and AD-4. Typical specially equipped versions of this aircraft, indicated by suffix letters, are the AD-3Q (radar counter-measures version), AD-3N (night bomber version) and AD-3W (special search version). The next entirely new Attack design by Douglas is the A2D-1.

The list below details the letters which have been allotted to aircraft manufacturers :—

B { Beech Aircraft Corporation / Boeing Aircraft Company
D Douglas Aircraft Company, Inc.
E { Cessna Aircraft Company, Inc. / Hiller Helicopters, Inc.
F Grumman Aircraft Engineering Corporation
H McDonnell Aircraft Corporation
J North American Aviation, Inc.
K Kaman Aircraft Corporation.
L Bell Aircraft Corporation
M Glenn L. Martin Company
N Naval Aircraft Development Center
P Piasecki Helicopter Corporation
Q Fairchild Engine and Aircraft Corporation
R Ryan Aeronautical Company
S Sikorsky Aircraft (United Aircraft Corporation)
T Northrop Aircraft, Inc.
U Chance Vought Aircraft, Inc.
V Lockheed Aircraft Corporation
Y Convair Division, General Dynamics Corporation.

Note : In 1952 it was announced that any aircraft ordered by both the U.S. Air Force and the U.S. Navy will retain the basic designation allotted by the first service to order it. The first example of this is provided by the North American trainer originally ordered by the U.S.A.F. as the T-28A. Subsequently adopted by the U.S. Navy, the naval version carries the designation T-28B.

AERO

AERO DESIGN AND ENGINEERING COMPANY.

HEAD OFFICE: P.O. Box 118, BETHANY, OKLAHOMA.

Chairman of the Board of Directors: George T. Pew.

President: Rufus T. Amis, Jr.

Vice-Presidents: W. D. Amis and T. R. Smith.

Chief of Production Engineering: A. H. Cronkhite.

Secretary and Treasurer: Budd Parks.

This Company was formed in October, 1950, to manufacture the all-metal Aero Commander twin-engined five/seven-seat light transport monoplane. The Aero Commander Model 520 received its Approved Type Certificate on January 30, 1952, and the first production aircraft was delivered to the *Chicago Tribune* on February 5, 1952. 150 were built before the Model 520 was succeeded in production by the Model 560 in 1954.

The 200th Aero Commander, a Model 560, was delivered to the Glenn L. Martin Company on February 21, 1955.

The U.S. Army acquired three Commander 520's for service trials. These aircraft carried the designation YL-26.

Fifteen standard Commander 560's have been supplied to the U.S.A.F. for use as V.I.P. transports. One has been reserved for the personal use of President Eisenhower.

The Aero Commander 560 (two 270 h.p. Lycoming GO-480 engines).

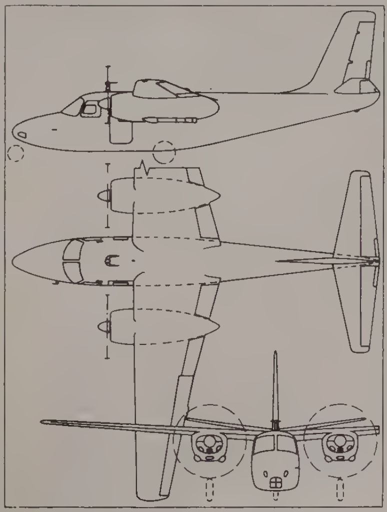
THE AERO COMMANDER 560.
U.S.A.F. designation: L-26B.

TYPE.—Twin-engined light transport Monoplane.

WINGS.—Cantilever high-wing monoplane. Wing section NACA 23012 modified. Aspect ratio 8.2. Chord (root) 8 ft. 4 in. (2.54 m.), (tip) 2 ft. 9 in. (1.14 m.). Dihedral 4°. Incidence 3° at root, —1° at tip. All-metal structure. Hydraulically-operated semi-slotted all-metal flaps between ailerons and fuselage. Total flap area 32.7 sq. ft. (3.04 m.²), total aileron area 20.5 sq. ft. (1.90 m.²). Gross wing area 242.5 sq. ft. (22.53 m.²).

FUSELAGE.—All-metal semi-monocoque structure with sheet metal covering.

TAIL UNIT.—Cantilever semi-monocoque all-metal structure with metal covering over all surfaces. Trim-tabs in elevators and rudder. Dihedral tailplane. Areas: fin 20.6 sq. ft. (1.91 m.²), rudder 13.4 sq. ft. (1.24 m.²), tailplane 33.06 sq. ft. (3.07 m.²), elevators 20.5 sq. ft. (1.90 m.²). Span of tailplane 16 ft. 11 in. (5.15 m.).



The Aero Commander 560.

LANDING GEAR.—Retractable tricycle type. Air-oil shock-absorbers. Hydraulic retraction. Goodyear wheels and Goodyear disc-type brakes. Track 12 ft. (3.66 m.). Wheelbase 13 ft. 6 in. (4.08 m.).

POWER PLANT.—Two 270 h.p. Lycoming GO-480-B six-cylinder horizontally-opposed air-cooled engines driving Hartzell two- (or optionally three-) blade constant-speed full-feathering metal airscrews. Fuel capacity 150 U.S. gallons (492 litres) in four bag-type cells in wing and one in fuselage.

ACCOMMODATION.—Enclosed cabin of 120 cub. ft. (3.4 m.³). Standard seating for two in front on individual adjustable seats with dual controls and full-width seat for three at rear of cabin. One or two additional seats may be added at extra cost. Main entry door under wing on port side. Door 20 in. (50.8 cm.) from ground. All equipment can be removed to permit cabin to be used for freight-carrying, and floor may be reinforced. Optional arrangement provides for both passengers and freight. Baggage compartment aft of cabin with capacity of 34 cub. ft. (0.95 m.³).

DIMENSIONS.—
- Span 44 ft. (13.42 m.).
- Length 34 ft. 2½ in. (10.44 m.).
- Height 14 ft. 9 in. (4.49 m.).

WEIGHTS AND LOADINGS.—
- Weight empty 3,900 lb. (1,769 kg.).
- Normal loaded weight 5,500 lb. (2,495 kg.).
- Max. permissible loaded weight 6,000 lb. (2,722 kg.).
- Wing loading 24.7 lb./sq. ft. (120 kg./m.²).
- Power loading 11.1 lb./h.p. (5.04 kg./h.p.).

PERFORMANCE (at normal A.U.W.).—
- Max. speed at S/L. 209 m.p.h. (336 km.h.).
- Cruising speed (70% rated power) at 10,000 ft. (3,050 m.) 200 m.p.h. (320 km.h.).
- Rate of climb at S/L. 1,600 ft./min. (488 m./min.).
- Rate of climb at S/L. on one engine 380 ft./min. (116 m./min.).
- Service ceiling 22,000 ft. (6,706 m.).
- Service ceiling on one engine 9,800 ft. (2,990 m.).
- Stalling speed at S/L. (flaps at 40°, landing-gear down, power off) 56 m.p.h. (90 km.h.).
- Stalling speed at S/L. (flaps and gear retracted, power off) 66 m.p.h. (106 km.h.).
- Stalling speed at S/L. (flaps at 40°, 75% rated power) 40 m.p.h. (64 km.h.).
- Range (at 55% S/L. rated power, 30 min. fuel reserve) at 10,000 ft. (3,050 m.) 1,100 miles (1,770 km.).
- Take-off distance to clear 50 ft. (15.25 m.), no wind 950 ft. (290 m.).

The Aero Commander 560 (two 270 h.p. Lycoming GO-480 engines).

AEROCAR

AEROCAR, INC.

HEAD OFFICE AND WORKS: LONGVIEW AIRPORT, WASH.

President and General Manager: Moulton B. Taylor.

Aerocar, Inc. was formed in February, 1948, to develop and build a flying automobile which has been designed by Mr. M. B. Taylor. A quarter scale model of the Aerocar was tested in the aeronautical laboratory of the University of Washington before actual construction of the prototype was begun in July, 1948. The prototype was completed in October, 1949 and has since been fully tested as both an aircraft and an automobile in over 75,000 miles of travel.

The company's facilities are being enlarged to permit the manufacture of a limited number of Aerocars. Four were nearing completion in 1955, and C.A.A. certification was expected late in 1955.

THE AEROCAR MODEL TWO.

The Aerocar is a convertible aeroplane and road vehicle which incorporates a number of features not previously introduced in craft of this type.

The four-wheel automobile section accommodates two seated side-by-side and encloses in the rear portion a 150 h.p. Lycoming engine which provides front-wheel automobile drive and drives a pusher propeller aft of the tail-unit. A three-control flight system is combined with the automobile controls, the same wheel being used for both. Conventional clutch and foot brake pedals are provided, together with three forward speeds and reverse in the wheel drive.

The flight section consists of a pair of rigidly-braced wings and a tail section which carries the tail and encloses the drive for the pusher propeller. When the flight section is detached from the body the wings, which have trailer wheels inset in the leading-edges of the wing roots, may be stowed on each side of the tail section and the flight section towed tail first behind the automobile section. The change-over from road transportation to aircraft can be accomplished without

special equipment by one person and all component locks are fool-proof.

TYPE.—Two/three-seat Flying Automobile.

WINGS.—High-wing rigidly-braced monoplane. Wing section NACA 42012. Aspect ratio 6. Dihedral 2°. 24ST aluminium-alloy structure. Area of ailerons (two) 30 sq. ft. (2.78 m.²). Gross wing area 190 sq. ft. (17.6 m.²).

FUSELAGE.—In two parts, the automobile body section and a detachable rear section carrying tail and propeller drive. 24ST aluminium-alloy construction, the auto body being covered with Fibreglas. The tail section is a monocoque.

TAIL UNIT.—Dihedral tailplane with fin and rudder beneath 24ST aluminium-alloy construction.

LANDING GEAR.—Dual-purpose quadricycle type. Gabriel Automotive hydraulic shock-absorbers. Magnesium wheels with 4.50 × 12 tyres. Goodrich expander tube brakes. Fluid-drive to front wheels for road traction. Wheel track 5 ft. 2 in. (1.57 m.). Wheel base 6 ft. 11 in. (2.13 m.).

POWER PLANT.—One 150 Lycoming O-320 engine. Hartzell ground-adjustable pusher propeller. Fuel capacity 24 U.S. gallons (90 litres). Oil capacity 2 U.S. gallons (7.5 litres).

EQUIPMENT.—Include windshield wipers, horn, battery, starter, generator, and all air and road lights and instruments required by U.S. vehicle codes.

DIMENSIONS (Aircraft).—
Span 34 ft. (10.37 m.).
Length 21 ft. (6.40 m.).
Height 7 ft. 2 in. (2.18 m.).

DIMENSIONS (Automobile).—
Length 10 ft. 4 in. (3.15 m.).
Trailer length 14 ft. (4.27 m.).
Overall car/trailer length 25 ft. (7.62 m.).
Height 5 ft. 4 in. (1.62 m.).
Auto wheel track 5 ft. 2 in. (1.57 m.).
Auto wheel base 6 ft. 11 in. (2.13 m.).
Max. width of trailer 8 ft. (2.44 m.).

WEIGHTS AND LOADINGS.—
Weight empty (auto) 1,012 lb. (460 kg.).
Pilot and passenger 340 lb. (154 kg.).
Fuel and oil 144 lb. (65 kg.).
Baggage 60 lb. (27 kg.).
Trailer (wing and tail) 396 lb. (180 kg.).
Flying weight loaded 1,950 lb. (885 kg.).
Wing loading 10 lb./sq. ft. (48.8 kg./m.²).
Power loading 14.1 lb./h.p. (6.35 kg./h.p.).

PERFORMANCE (Aircraft).—
Max. speed over 110 m.p.h. (176 km.h.).
Cruising speed over 100 m.p.h. (160 km.h.).
Landing speed (with flaps) 50 m.p.h. (80 km.h.).
Initial rate of climb over 500 ft./min. (152 m./min.).
Service ceiling 12,000 ft. (3,660 m.).
Cruising range 300 miles (480 km.).
Take-off run 655 ft. (200 m.).
Landing run 300 ft. (91.5 m.).
Distance to clear 50 ft. (15.25 m.) 1,225 ft. (374 m.).

PERFORMANCE (Automobile).—
Max. road h.p. 40.
Designed road speed 60 m.p.h. (96 km.h.).
Max. permissible road speed 85 m.p.h. (136 km.h.).
Road range over 500 miles (800 km.).
Road turning radius 15 ft. (4.57 m.).

The Aerocar Two-seat Roadable Monoplane in flight.

AERONCA

THE AERONCA MANUFACTURING CORPORATION.

HEAD OFFICE AND WORKS: MIDDLETOWN MUNICIPAL AIRPORT, OHIO.

President: John A. Lawler.

Director of Engineering: George A. Page.

Chief Engineer: Leon C. Wolfe.

Secretary and Treasurer: S. J. Kuderer.

This Company was incorporated as the Aeronautical Corporation of America in November, 1928, and was the first American company to build and market a truly light aeroplane.

In mid-1950 Aeronca abandoned light aeroplane manufacture when it began producing parts and sub-assemblies of military aircraft under sub-contract in connection with the U.S. defense programme. The name of the company was then changed to the Aeronca Manufacturing Corporation.

Approximately 95 per cent. of the company's current activities are concerned with the manufacture of assemblies and sub-assemblies for military aircraft, such as the Boeing B-52 and B-47 and other major production types.

While this work continues, Aeronca is preparing to re-enter the civil aircraft market with a new ten-seat twin-engined executive transport to be powered by two 1,525 h.p. Wright R-1820 Cyclone engines. The aircraft will be a high-wing monoplane and the pressurised cabin will seat eight passengers. A prototype is under construction. No further details are available.

In June, 1954, Aeronca sold the manufacturing rights of its Model 7 Champion to Flyers Service, Inc. of St. Paul, Minn. which company has formed the Champion Aircraft Corporation to continue the manufacture of this popular model.

Between 1946 and 1951 Aeronca built over 10,000 Model 7 Champions, and more than 600 L-16A and L-16B military liaison and training versions of the same basic aircraft were supplied to the Army Ground Forces.

AMERICAN HELICOPTER

AMERICAN HELICOPTER DIVISION, FAIRCHILD ENGINE AND AIRPLANE CORPORATION.

DIVISIONAL OFFICE AND WORKS: 1800 ROSECRANS AVENUE, MANHATTAN BEACH, CALIFORNIA.

General Manager: Howard E. Roberts.

On April 1, 1954, the Fairchild Engine and Airplane Corporation took over the American Helicopter Company, Inc., which is now a division of Fairchild.

No active helicopter programme exists at this Division, nor is any planned for the near future.

All work on the XH-26 pulsejet-driven lightweight helicopter, which has been fully described and illustrated in previous editions of this Annual, has been terminated by the U.S. Government.

BAUMANN

BAUMANN AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: 5514, SATSUMA STREET, NORTH HOLLYWOOD, CALIFORNIA.

President: J. B. Baumann.

Secretary and Treasurer, Business Manager: P. H. Bruns.

The Baumann Aircraft Corpn. was formed in 1945 by Mr. J. B. Baumann and a group of designers and builders, who have been working together for several years. Their first design was the Model B-250 Brigadier, a twin-engined pusher monoplane intended for executive transport duties. The prototype Brigadier first flew in June, 1947.

Pilot production of the B-290, which is identical to the B-250 except that it is fitted with engines of higher rating, has begun. The company planned to have production up to one Brigadier per week by the end of 1955.

THE BAUMANN B-290 BRIGADIER.

TYPE.—Twin-engined five-seat pusher monoplane.

WINGS.—Cantilever shoulder-wing monoplane. Metal spars and ribs and sheet metal covering. All-metal ailerons, with hydraulically-operated all-metal slotted trailing-edge flaps between nacelles and fuselage. Wing area (approximate) 209 sq. ft. (19.42 m.²).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Metal framework with metal covering for all surfaces. Controllable rudder and elevator trim-tabs. Tailplane span 13 ft. 2 in. (4.01 m.).

LANDING GEAR.—Retractable tricycle type. Main wheels, on single oleo shock-absorber legs, retract outward into wings outboard of engines. Hydraulic operation. Hydraulic brakes and Goodyear tyres. Track 12 ft. (3.66 m.). Nose-wheel is steerable.

POWER PLANT.—Two 145 h.p. Continental C145-H six-cylinder horizontally-opposed air-cooled engines mounted within centre-section as pusher units and driving Hartzell constant-speed full-feathering two-blade propellers. Fuel capacity 76 U.S. gallons (288 litres).

ACCOMMODATION.—Enclosed cabin seating pilot (on port) and one passenger side-by-side with dual controls, and full-width seat for three passengers behind. Access door on port side. Baggage compartment of 70 cub. ft. (1.98 m.³) capacity aft of rear seats.

DIMENSIONS.—
Span 41 ft. (12.49 m.).
Length 27 ft. 5 in. (8.36 m.).
Height (overall) 10 ft. 2 in. (3.10 m.).

WEIGHTS AND LOADINGS.—
Weight empty 2,700 lb. (1,226 kg.).

The Baumann B-290 Brigadier (two 145 h.p. Continental engines).

Disposable load 1,325 lb. (602 kg.).
Payload 880 lb. (400 kg.).
Weight loaded 4,025 lb. (1,828 kg.).
Wing loading 19.25 lb./sq. ft. (93.9 kg./m.^{2}).
Power loading 13.8 lb./h.p. (6.26 kg./h.p.).

PERFORMANCE.—
Max. speed 190 m.p.h. (304 km.h.).
Max. speed on one-engine 110 m.p.h. (177 km.h.).
Cruising speed (75% power) 165 m.p.h. (264 km.h.).
Landing speed (without flaps) 63 m.p.h. (101 km.h.).
Landing speed (with flaps) 57 m.p.h. (91.2 km.h.).
Stalling speed (power off) 57 m.p.h. (91.2 km.h.).
Stalling speed (power on) 45 m.p.h. (72 km.h.).
Initial rate of climb 1,250 ft./min. (381 m./min.).
One-engine rate of climb 450 ft./min. (137 m./min.).
Service ceiling 18,000 ft. (5,485 m.).
One-engine ceiling 8,000 ft. (2,440 m.).
Cruising range 750 miles (1,200 m.).

BEE

BEE AVIATION ASSOCIATES, INC.

HEAD OFFICE: 1536 MISSOURI STREET, SAN DIEGO 9, CALIFORNIA.

President: William F. Chana.

Vice-President—Engineering: K. S. Coward.

The founders of this company, were responsible for the Wee Bee monoplane, which was claimed to be big enough to lift a man yet small enough to be lifted by one. The Wee Bee, which was demonstrated in the United States and England several years ago, was notable for the fact that the pilot lay prone on the fuselage.

Bee Aviation Associates, Inc., which was incorporated on March 21, 1951, has now produced the Honey Bee monoplane, which flew for the first time on July 12, 1952, and was awarded its Approved Type Certificate in 1953.

Under development are an 85 h.p. two-seat version of the Honey Bee and a small 150 h.p. four-seat cabin monoplane which will be known as the Queen Bee. This will be a low-wing monoplane with retractable landing-gear and "butterfly" tail.

The Honey Bee Light Monoplane (65 h.p. Continental A65 engine).

THE HONEY BEE.

TYPE.—Single-seat light monoplane.

WINGS.—High-wing cantilever monoplane. NACA 4418 (modified) wing section. Aspect ratio 8.17. All-metal monospar stressed-skin structure. Aileron area 5.35 sq. ft. (0.49 m.^{2}) each. Gross wing area 96 sq. ft. (8.92 m.^{2}).

FUSELAGE.—All-metal stressed-skin structure.

TAIL UNIT.—45° "Butterfly" type. NACA 0012-64 (modified) aerofoil section. Stabiliser area 12.5 sq. ft. (0.116 m.^{2}) total. Elerudder area 12.5 sq. ft. (0.116 m.^{2}) total.

LANDING GEAR.—Fixed nose-wheel type. Cantilever spring steel main legs. Steerable nose-wheel. Main wheel track 6 ft. 8 in. (2.03 m.). Wheelbase 4 ft. 4½ in. (1.33 m.).

POWER PLANT.—One 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine. Two-blade Flothorp fixed-pitch airscrew, 5 ft. 6 in. (1.67 m.) diameter.

ACCOMMODATION.—Enclosed cabin for pilot below wing.

DIMENSIONS.—
Span 28 ft. (8.54 m.).
Length 16 ft. 10 in. (5.13 m.).
Height 7 ft. 8 in. (2.34 m.).

WEIGHTS AND LOADINGS.—
Weight empty 610 lb. (277 kg.).
Weight loaded 860 lb. (390 kg.).
Wing loading 8.95 lb./sq. ft. (43.67 kg./m.^{2}).
Power loading 13.25 lb./h.p. (6.0 kg./h.p.).

PERFORMANCE.—Max. speed 120 m.p.h. (192 km.h.).
Cruising speed 110 m.p.h. (176 km.h.).
Stalling speed (power off) 45 m.p.h. (72 km.h.).
Initial rate of climb 1,000 ft./min. (305 m./min.).
Service ceiling 15,000 ft. (4,575 m.).
Range 240 miles (384 km.).

BEECHCRAFT

BEECH AIRCRAFT CORPORATION.

HEAD OFFICE AND MAIN WORKS: EAST CENTRAL AVENUE, WICHITA, KANSAS.

BRANCH FACTORIES: HERINGTON AND LIBERAL, KANSAS.

President: Mrs. O. A. (Walter H.) Beech.

Vice-President and General Manager: J. P. Gaty.

Vice-President and Co-ordinator: Frank E. Hedrick.

Vice-President—Manufacturing: C. C. Pearson.

Vice-President—Contract Administration: James N. Lew.

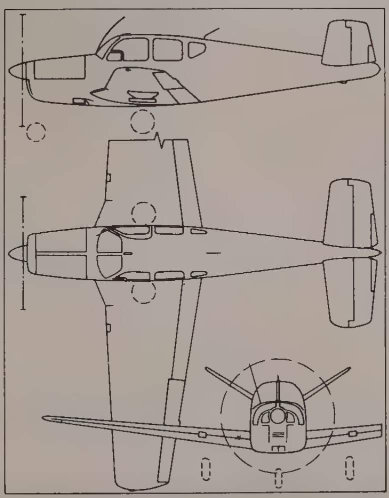
Vice-President—Military Sales: Lynn D. Richardson.

Secretary and Treasurer: John A. Elliott.

Assistant Secretary: L. Winters.

Founded in 1932 by the late Walter H. Beech, pioneer designer and builder of light aeroplanes in the United States, the Beech Aircraft Corporation is currently engaged in the production of both military and civil aircraft.

Current production civil aircraft include the four-seat Model F35 Bonanza, the six-seat C50 Twin-Bonanza, and the new eight-seat Model E18S Super 18. Military aircraft in production include the L-23B, a six-seat liaison version of the Twin-Bonanza for the U.S. Army, the T-34A Mentor trainer for the U.S.A.F. and the T-34B Mentor trainer for the U.S. Navy.



The Beechcraft Bonanza.

The T-34A Bonanza is also in production in Canada for the R.C.A.F. and in Japan for the Japanese National Safety Forces. Mentor trainers have been supplied to the air forces of Chile, Colombia and El Salvador.

Beech Aircraft's three plants in Wichita, Herington and Liberal are also engaged in extensive major sub-contract and research work in the development of advanced jet and guided missile products. Current sub-contracts include work on the Lockheed T-33A, the Republic F-84F and the McDonnell F-101A. External ground power sources generators and fuel tanks are also being built for the U.S. Air Force.

The Beechcraft Bonanza (205 h.p. Continental E185 engine).

THE BEECHCRAFT MODEL F35 BONANZA.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Beech modified NACA 23000 series aerofoil section. All-metal structure. All-metal ailerons with controllable trim-tabs in each. NACA slotted flaps between ailerons and fuselage. Wing area 177.6 sq. ft. (16.49 m.^{2}).

FUSELAGE.—Metal structure with flush-riveted metal skin.

TAIL UNIT.—"Butterfly" type consisting of tailplane and elevators set at acute dihedral angle. Elevators act also as rudders. Balanced elevators with controllable trim-tab in each. Tailplane span 10 ft. 1⅝ in. (3.08 m.).

LANDING GEAR.—Retractable tricycle type. Beech air-oil shock struts. Doors close when wheels are in extended position. Track 9 ft. 7½ in. (2.93 m.). Goodyear wheels with single-disc hydraulic brakes. Goodyear nose-wheel on Beech air-oil strut, is steerable and has anti-shimmy device.

POWER PLANT.—One 205 h.p. Continental E185-11 or 225 h.p. E225-8 six-cylinder

horizontally-opposed air-cooled engine. Beech B-215 two-blade electrically-controlled continuously variable-pitch airscrew, 7 ft. (2.13 m.) diameter. Standard fuel capacity 39 U.S. gallons (148 litres) in two wing tanks. Optional auxiliary wing tanks (18 U.S. gallons = 68 litres) or baggage compartment auxiliary tank (10 U.S. gallons = 37.8 litres). Oil capacity 2½ U.S. gallons (9.5 litres).

Accommodation.—Four-seat enclosed cabin. Two seats side-by-side in front, with orthodox throw-over dual controls, and full-width seat behind. Cabin dimensions 6 ft. 11 in. long × 3 ft. 6 in. wide × 4 ft. 2 in. high (2.11 × 1.07 × 1.27 m.). Access door 3 ft. × 3 ft. 1 in. (0.91 × 0.916 m.) on starboard side. Acrylic moulded windscreen and windows. Middle windows open for ground ventilation, and have release pins to permit their use as emergency exits. Cabin structure reinforced for protection in turn-over. Baggage compartment with capacity of 16.5 cub. ft. (0.47 $m.^3$) and allowance of 270 lb. (122.5 kg.) aft of seats. Access door 2 ft. × 1 ft. 10 in. (0.61 × 0.56 m.) on starboard side of fuselage.

Dimensions.—
- Span 32 ft. 10 in. (10 m.).
- Length 25 ft. 2 in. (7.67 m.).
- Height 6 ft. 6½ in. (2 m.).

Weights and Loadings.—
- Weight empty (fully equipped) 1,697 lb. (770 kg.).
- Useful load 1,053 lb. (478 kg.).
- Pay load with max. fuel 800 lb. (363 kg.).
- Weight loaded 2,750 lb. (1,248 kg.).
- Wing loading (fully loaded) 15.5 lb./sq. ft. (75.64 kg./$m.^2$).
- Power loading (fully loaded) 13.4 lb./h.p. (6.08 kg./h.p.).

Performance (205 h.p. Continental E185 engine).—
- Max. speed 190 m.p.h. (304 km.h.) at sea level.
- Recommended cruising speed (75% power) 180 m.p.h. (288 km.h.) at 6,000 ft. (1,830 m.).
- Econ. cruising speed (65% power) 175 m.p.h. (282 km.h.) at 8,000 ft. (2,440 m.).
- Stalling speed at sea level (without flaps) 66 m.p.h. (106 km.h.).
- With flaps at 30 degrees 55 m.p.h. (88 km.h.).
- Rate of climb at sea level 1,100 ft./min. (335 m./min.).
- Service ceiling 18,000 ft. (5,490 m.).
- Range (normal fuel) at 165 m.p.h. (264 km.h.) at 10,000 ft. (3,050 m.) 775 miles (1,240 km.).
- Take-off run in 10 m.p.h. (16 km.h.) wind at sea level (20° flaps) 590 ft. (180 m.).
- Landing run in 10 m.p.h. (16 km.h.) wind at sea level (30° flaps) 227 ft. (79 m.).

Performance (225 h.p. Continental E225 engine).—
- Max. speed 194 m.p.h. (310 km.h.) at sea level.
- Recommended cruising speed (65% power) 184 m.p.h. (291 km.h.) at 8,000 ft. (2,440 m.).
- Econ. cruising speed (53.3% power) 175 m.p.h. (282 km.h.) at 8,000 ft. (2,440 m.).
- Rate of climb at sea level 1,300 ft./min. (396 m./min.).
- Service ceiling 19,000 ft. (5,795 m.).
- Range (normal fuel) at 165 m.p.h. (264 km.h.) at 10,000 ft. (3,050 m.) 775 miles (1,240 km.).
- Take-off run in 10 m.p.h. (16 km.h.) wind at sea level (20° flaps) 500 ft. (152 m.).
- Landing run in 10 m.p.h. (16 km.h.) wind at sea level (30° flaps) 227 ft. (69 m.).

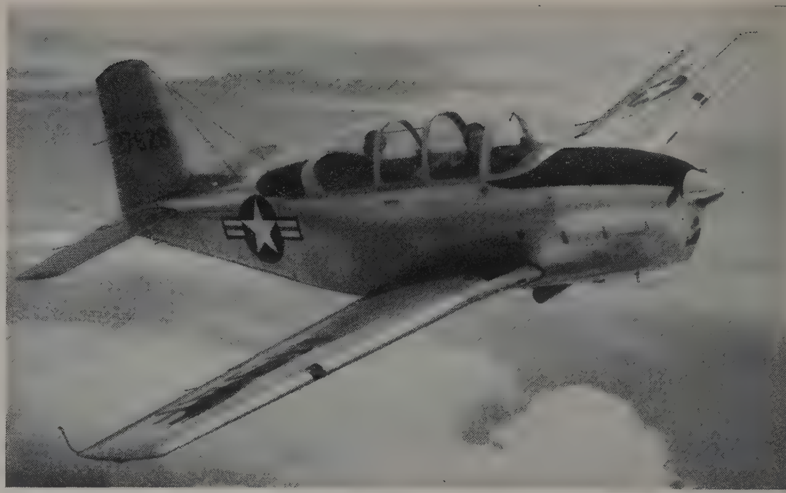
THE BEECHCRAFT MODEL 45 MENTOR.

U.S.A.F. designation: T-34A.
U.S. Navy designation: T-34B.

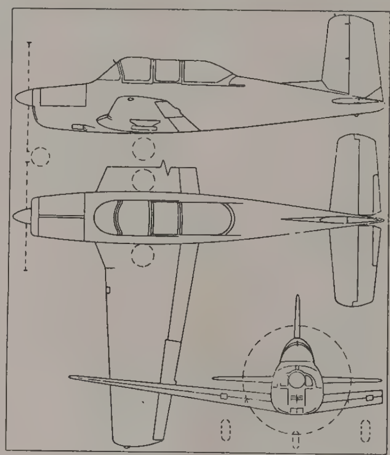
The Model 45 Mentor has been inexpensively developed from the Bonanza as a two-seat primary trainer. The U.S.A.F. acquired three Model 45's under the designation YT-34 for general evaluation and test, as the result of which the Mentor has been selected as the new primary trainer for the U.S.A.F. under the designation T-34A.

Large contracts for the T-34A have been placed with the Beech Aircraft Corporation and with Beech's licensees, the Canadian Car and Foundry Co., Ltd. of Fort William, Ontario, and Fuji Heavy Industries of Tokyo, Japan.

In 1954 the Mentor was adopted by the U.S. Navy as a replacement for the North American SNJ trainer. Only a few major changes in the basic design were needed to enable the Mentor to meet the U.S. Navy specification. The naval version, which is now in production, carries the designation T-34B.



The Beechcraft T-34A Mentor (225 h.p. Continental O-470 engine).



The Beechcraft Mentor.

Type.—Two-seat Primary Trainer.

Wings.—Low-wing cantilever monoplane. Same type structure as for the Bonanza. Ailerons and flaps of magnesium. Electrical flap operation. Wing area 177.6 sq. ft. (16.49 $m.^2$).

Fuselage.—Metal structure with flush-riveted metal skin.

Tail Unit.—Conventional cantilever monoplane type. All-metal structure of magnesium. Adjustable trim-tabs in elevators and rudder.

Landing Gear.—Retractable tricycle type. Same as for Bonanza. Electric retraction with emergency hand control. Beech air-oil struts on all wheels. Goodyear wheels with single disc hydraulic brakes. Main wheel inboard doors close when wheels are down to keep out mud and dirt and to prevent buffeting damage. Nose-wheel is steerable and tyre has mud scraper to keep dirt off bottom of fuselage. Wheel track 9 ft. 7½ in. (2.94 m.).

Power Plant.—One 225 h.p. Continental O-470-13 six-cylinder horizontally-opposed air-cooled engine. Beech Model 278-101 all-metal constant-speed airscrew 7 ft. 4 in. (2.23 m.) in diameter. Two wing fuel tanks. Capacity 50 U.S. gallons (225 litres). Oil capacity 2½ U.S. gallons (9.45 litres). Entire power-plant assembly including engine, airscrew, accessories and oil system, may be changed as a unit.

Accommodation.—Tandem cockpits under continuous transparent canopy with sections over each seat which may be independently opened or latched in intermediate positions. Conventional three-control system duplicated in each cockpit. Adjustable seats in both cockpits. Heating and ventilation. Windshield de-froster. Radio receiver, with range, reception and transmission. Baggage compartment aft of rear cockpit.

Dimensions.—
- Span 32 ft. 10 in. (10 m.).
- Length 25 ft. 11 in. (7.9 m.).
- Height (over tail) 9 ft. 7 in. (2.9 m.).

Weights and Loadings.—
- Weight loaded 2,900 lb. (1,317 kg.).
- Wing loading 16.3 lb./sq. ft. (79.54 kg./$m.^2$).
- Power loading 12.9 lb./h.p. (5.85 kg./h.p.).

Performance.—
- Max. speed at S/L. 189 m.p.h. (302 km.h.).
- Max. cruising speed 173 m.p.h. (277 km.h.). at 10,000 ft. (3,050 m.).
- Stalling speed (flaps down) 53.5 m.p.h. (85.6 km.h.).
- Rate of climb at S/L. 1,230 ft./min. (375 m./min.).
- Service ceiling 20,000 ft. (6,100 m.).
- Max. cruising range 975 miles (1,560 km.).
- Take-off to 50 ft. (15.25 m.) no wind (10° flaps) 1,200 ft. (366 m.).
- Landing run from 50 ft. (15.25 m.) no wind (full flaps) 960 ft. (293 m.).

THE BEECHCRAFT MODEL C50. TWIN-BONANZA.

U.S.A.F. designation: L-23.

A number of Twin-Bonanzas have been acquired by the U.S. Army Field Forces, under the designation L-23, for staff

The Beechcraft Twin-Bonanza (two 275 h.p. Lycoming GO-480 engines).

transport and general liaison duties (see separate description).

TYPE.—Twin-engined six-seat Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23014.1 at root, NACA 23012 at tips. Aspect ratio 7.51. Dihedral 7°. Incidence 5.8° at root, 1° at tip. All-metal structure. NACA slotted flaps. Frise type ailerons. Areas: flaps 37.8 sq. ft. (3.51 $m.^2$), ailerons 13.89 sq. ft. (1.29 $m.^2$). Gross wing area 277 sq. ft. (25.83 $m.^2$).

FUSELAGE.—Metal structure with flush-riveted metal skin.

TAIL UNIT.—Cantilever monoplane type. Slight dihedral to tailplane. All-metal structure. Areas: fin 14.25 sq. ft. (1.32 $m.^2$), rudder 12.77 sq. ft. (1.18 $m.^2$), tailplane 47.25 sq. ft. (4.39 $m.^2$), elevators 17.49 sq. ft. (1.62 $m.^2$). Tailplane span 16 ft. 4 in. (4.98 m.).

LANDING GEAR.—Retractable tricycle type Electric actuation. Main shock-strut assemblies interchangeable on either side. Single-disc hydraulic brakes. Nose wheel is steerable. Main wheel track 12 ft. 9 in. (3.88 m.). Wheelbase 10 ft. 9 in. (3.28 m.).

POWER PLANT.—Two 275 h.p. Lycoming GO-480-F6 six-cylinder horizontally-opposed air-cooled engines. Beech airscrews with aluminium-alloy blades, hydraulically controlled, continuously variable-pitch with electric feathering. Fuel capacity 134 U.S. gallons, 88 gallons in inboard wing tanks and 46 gallons in auxiliary outboard wing tanks.

ACCOMMODATION.—Enclosed cabin seating a maximum of six; pilot, co-pilot and passenger on front seat 54 in. (1.37 m.) wide and three passengers on rear seat 52 in. (1.32 m.) wide. Two baggage compartments one forward and one aft. A stretcher patient can be loaded through rear baggage door without need to climb on wing. Capacity of front baggage compartment 14 cub. ft. (0.4 $m.^3$), rear compartment 41 cub. ft. (1.16 $m.^3$). Equipment includes cabin sound-proofing, heating and ventilation, and choice of radio installations.

DIMENSIONS.—
- Span 45 ft. 3⅜ in. (13.81 m.).
- Length 31 ft. 6½ in. (9.61 m.).
- Height 11 ft. 4 in. (3.46 m.).

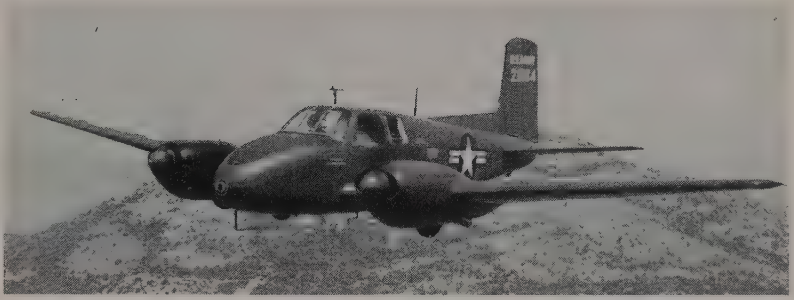
WEIGHTS AND LOADINGS.—
- Weight empty 3,928 lb. (1,783 kg.).
- Weight loaded 6,000 lb. (2,724 kg.).
- Wing loading 21.66 lb./sq. ft. (105.7 kg./$m.^2$).
- Power loading 11.32 lb./h.p. (5.14 kg./h.p.).

PERFORMANCE.—
- Max. speed at 2,500 ft. (760 m.) 210 m.p.h. (336 km.h.).
- Cruising speed (66.6% power) at 10,000 ft. (3,050 m.) 200 m.p.h. (320 km.h.).
- Max. permissible speed 227 m.p.h. (363 km.h.).
- Landing speed (full flaps) 69 m.p.h. (110 km.h.).
- Rate of climb at S/L. 1,450 ft./min. (442 m./min.).
- Single-engine climb at S/L. 300 ft./min. (91 m./min.).
- Service ceiling 20,000 ft. (6,100 m.).
- Single-engine ceiling 8,400 ft. (2,560 m.).
- Max. range (at 115 b.h.p., no reserve) at 10,000 ft. (3,050 m.) 1,100 miles (1,760 km.).
- Take-off to 50 ft. (15.25 m.) S/L. and no wind 410 yds. (374 m.).
- Landing over 50 ft. (15.25 m.) no wind 458 yds. (418 m.).

THE BEECHCRAFT L-23B.

The L-23B is a military version of the earlier Model B50 Twin-Bonanza and is used by the U.S. Army Field Forces as a staff transport and for general liaison duties.

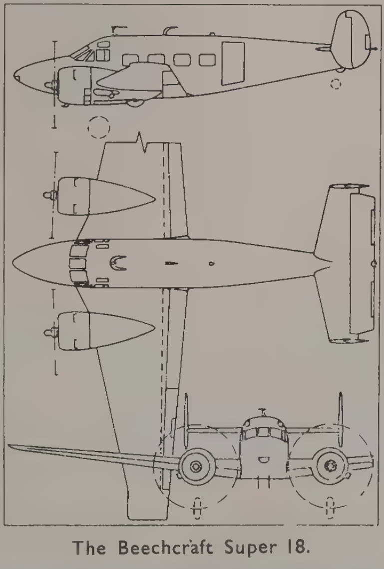
The L-23B is powered by two 260 h.p. Lycoming GO-435-C2 engines but otherwise the general structural description of the civil Model C50 Twin-Bonanza previously described applies to this aircraft. The latest Model C50 has two additional windows, higher-powered engines, increased performance and other improvements which differentiate it from the L-23B, whose specification follows.


The Beechcraft L-23B (two 260 h.p. Lycoming GO-435 engines).

DIMENSIONS.—
- As for Model C50 except:—
- Height 11 ft. 5 in. (3.45 m.).

WEIGHTS AND LOADINGS.—
- Weight empty 3,940 lb. (1,870 kg.).
- Weight loaded 6,000 lb. (2,724 kg.).
- Wing loading 21.66 lb./sq. ft. (105.7 kg./$m.^2$).
- Power loading 12.25 lb./h.p. (5.57 kg./h.p.).

PERFORMANCE.—
- Max. speed at 2,500 ft. (760 m.) 205 m.p.h. (328 km.h.).
- Cruising speed (65% power) at 10,000 ft. (3,050 m.) 192 m.p.h. (307 km.h.).
- Max. permissible speed 227 m.p.h. (363 km.h.).
- Landing speed (full flaps) 69 m.p.h. (110 km.h.).
- Rate of climb at S/L. 1,450 ft./min. (442 m./min.).
- Single-engine climb at S/L. 300 ft./min. (91 m./min.).
- Service ceiling 20,000 ft. (6,100 m.).
- Single-engine ceiling 8,400 ft. (2,560 m.).
- Max. range (65% power) at 10,000 ft. (3,050 m.) 961 miles (1,538 km.).
- Take-off to 50 ft. (15.25 m.) at S/L. no wind 410 yds. (374 m.).
- Landing from 50 ft. (15.25 m.), no wind 458 yds. (418 m.).


The Beechcraft Super 18.

THE BEECHCRAFT SUPER 18.

The Super 18 is a new version of the civil Model D18S described later. It incorporates a number of structural and equipment improvements, including a slightly increased span, improved sound-proofing, a modified flight compartment, integral entrance steps, etc. The two 450 h.p. Pratt & Whitney R-985-14ANB engines are fitted with ejector exhaust pipes. The all-up weight has been increased by 550 lb. (250 kg.) and all-round performance has been improved.

DIMENSIONS.—
- Span 49 ft. 8 in. (15.14 m.).
- Length 35 ft. $2\frac{1}{16}$ in. (10.70 m.).
- Height 12 ft. 3½ in. (3.74 m.).

WEIGHTS AND LOADINGS.—
- Weight empty (equipped) 5,970 lb. (2,710 kg.).
- Disposable load 3,330 lb. (1,430 kg.).
- Weight loaded 9,300 lb. (4,222 kg.).
- Wing loading 25.75 lb./sq. ft. (135.66 kg./$m.^2$).
- Power loading 10.32 lb./h.p. (4.68 kg./h.p.).

PERFORMANCE.—
- Max. speed 234 m.p.h. (374 km.h.) at 3,300 ft. (1,512 m.).
- Cruising speed (66.7% METO) 207 m.p.h. (331 km.h.) at 5,000 ft. (1,525 m.), 215 m.p.h. (344 km.h.) at 10,000 ft. (3,050 m.).
- Cruising speed (57.7% METO) 196 m.p.h. (314 km.h.) at 5,000 ft. (1,525 m.), 205 m.p.h. (328 km.h.) at 10,000 ft. (3,050 m.).
- Cruising speed (53.3% METO) 190 m.p.h. (304 km,h.) at 5,000 ft. (1,525 m.) 199 m.p.h. (318 km.h.) at 10,000 ft. (3,050 m.).
- Max. rate of climb at S/L. 1,350 ft./min. (412 m./min.).
- Rate of climb on one engine at S/L. 320 ft./min. (98 m./min.).
- Rate of climb on one engine at 5,000 ft. (1,525 m.) 205 ft./min. (62.5 m./min.).
- Service ceiling 23,300 ft. (7,106 m.).
- Service ceiling on one engine 8,700 ft. (2,650 m.).
- Max. range at 182 m.p.h. (291 km.h.) at 10,000 ft. (3,050 m.) (with 45 min. reserve) 1,495 miles (2,610 km.).
- Max. range at 215 m.p.h. (344 km.h.) at 10,000 ft. (3,050 m.) (with 45 min. reserve) 1,290 miles (2,175 km.).
- Take-off distance to 50 ft. (15.25 m.) at S/L. 600 yds. (549 m.).
- Landing distance from 50 ft. (15.25 m.) at S/L. 566 yds. (418 m.).


The Beechcraft Super 18 (two 450 h.p. Pratt & Whitney R-985 engines).
(*Gordon Williams*).

THE BEECHCRAFT MODEL D18S.

U.S.A.F. designation: C-45H.
U.S. Navy designation: SNB-5.
R.C.A.F. name: Expeditor.

TYPE.—Twin-engined Light Transport.

WINGS.—Low-wing cantilever monoplane. All-metal structure with a smooth skin covering flush-riveted over leading-edge. Duralumin-framed ailerons and flaps, with fabric covering. Trimming-tab in left aileron. Electrical flap operation. Wing area 349 sq. ft. (32.4 $m.^2$).

FUSELAGE.—Metal structure covered with a smooth skin, flush-riveted on the nose section.

TAIL UNIT.—Monoplane type with twin fins

and rudders. Stressed-skin tailplane and fins. Rudder and elevators have aluminium-alloy frames with fabric covering. Trimming-tabs on both rudders and on each half of elevator.

LANDING GEAR.—Retractable tail-wheel type. Electric actuation. Beech air-oil shock-absorbers. Low-pressure wheels and hydraulic brakes of the single-disc ventilated type with controls for both pilot and co-pilot.

POWER PLANT.—Two 450 h.p. Pratt & Whitney R-985-B5 Wasp Junior radial air-cooled engines. Hamilton-Standard Hydromatic constant-speed airscrews 8 ft. 3 in. (2.51 m.) in diameter. Normal tankage in wings with total capacity 206 U.S. gallons (780 litres). Additional long-range tank may be installed in nose of fuselage in place of baggage compartment. Capacity of nose tank 80 U.S. gallons (302 litres).

ACCOMMODATION.—Pilot's compartment in nose, seating two side-by-side, with dual controls. Passenger cabin seats five to seven passengers. Baggage compartments in extreme nose and behind cabin. Sound-proofing, controlled ventilation and heating.

DIMENSIONS.—
Span 47 ft. 7 in. (14.5 m.).
Length 33 ft. 11½ in. (10.4 m.).
Height 9 ft. 2½ in. (2.8 m.).

The Beechcraft C-45H (two 450 h.p. Pratt & Whitney R-985 engines). (*Gordon Williams*).

WEIGHTS AND LOADINGS.—
Weight empty 5,770 lb. (2,620 kg.).
Weight loaded 8,750 lb. (3,980 kg.).
Wing loading 25.1 lb./sq. ft. (122.4 kg./m.^{2}).
Power loading 10.92 lb./h.p. (4.96 kg./h.p.).

PERFORMANCE.—
Max. speed 230 m.p.h. (370 km.h.) at 5,000 ft. (1,525 m.).
Cruising speed 211 m.p.h. (338 km.h.) at 10,000 ft. (3,050 m.).
Stalling speed 77 m.p.h. (123 km.h.).
Rate of climb 1,190 ft./min. (363 m./min.).
Climb on one engine 225 ft./min. (68.6 m./min.).
Service ceiling 20,500 ft. (6,250 m.).
Range (normal—no reserve) 1,125 miles (1,585 km.).
Max. range (with nose tank—no reserve) 1,500 miles (2,400 km.).
Take-off to 50 ft. (15.25 m.) no wind 1,760 ft. (537 m.).
Landing distance from 50 ft. (15.25 m.) no wind 1,460 ft. (445 m.).

BELL

BELL AIRCRAFT CORPORATION.

HEAD OFFICE: P.O. BOX 1, BUFFALO 5, N.Y.

NIAGARA FRONTIER DIVISION: NIAGARA FALLS, N.Y.

TEXAS (HELICOPTER) DIVISION: FORT WORTH, TEXAS.

President: Lawrence D. Bell.

Executive Vice-President: Lieut. Gen. W. E. Kepner, U.S.A.F. (Ret.).

Vice-President, General Manager and Treasurer: Leston P. Faneuf.

First Vice-President: Ray P. Whitman.

Vice-President—Manufacturing: Julius J. Domonkos.

Vice-President—Helicopters: Harvey Gaylord.

Vice-President—Engineering: Roy J. Sandstrom.

Secretary and Comptroller: William G. Gisel.

The Bell Aircraft Corpn. was formed in 1935 by Lawrence D. Bell, formerly Vice-President and General Manager of the Consolidated Aircraft Corpn., R. P. Whitman, who was Assistant General Manager of Consolidated, and Robert J. Woods, Consolidated's Chief Engineer. When Consolidated moved its factory from Buffalo to San Diego, Cal., these three men remained in Buffalo to form the new company.

Bell was early in the field in helicopter development. Following two years' development work, an experimental Model 30 was flying in 1943, and this craft was superseded late in 1945 by the first of the Model 47 Series. This helicopter received the first helicopter Approved Type Certificate from the C.A.A. on May 8, 1946. The Model 47 has been in continuous production in both military and commercial forms since 1946.

Helicopter output at Fort Worth, Texas, in 1954 exceeded that of all other rotary-wing aircraft manufacturers. Production involved mainly the Model 47 and the HSL-1 for the U.S. Navy, and experimental and development work proceeded with various craft of advanced design.

Bell is currently engaged in both the guided missile and rocket propulsion fields. In 1954 it was announced that Bell had developed and was building the GAM-63 Rascal air-to-ground missile for the U.S.A.F. No details of this missile are available.

In the rocket propulsion field Bell is delivering production versions of one of its rocket products to another aircraft manufacturer for guided missile use, and is continuing in the research and development of high-thrust rocket power-plants.

Total employment in 1954 at 17,725, with 14,075 in the Niagara Frontier Division, was the highest since the war.

THE BELL X-1.

The X-1 was designed jointly by Bell, the U.S.A.F. and the N.A.C.A. specifically to investigate supersonic flight problems. It is powered by a Reaction Motors bi-fuel rocket motor capable of developing a maximum static thrust of 6,000 lb.

Six aircraft of four slightly differing versions of the X-1 have been built and these are described separately below.

X-1. Powered by a Reaction Motors E6000-C4 bi-fuel rocket motor capable of developing a maximum thrust of 6,000 lb. (2,722 kg.). Was originally intended to be fitted with a turbine fuel pump system but as this had not been fully developed in time, a pressurised system, in which nitrogen under pressure forced the fuel into the burners, was used. This reduced fuel endurance from 4 to 2½ minutes at full power and limited the maximum speed to 967 m.p.h. (1,550 km.h.). The first X-1 made its first flight under its own power on December

The Bell X-1A and X-1B Supersonic Research Monoplane.

9, 1946, after being dropped at altitude from a B-29. The X-1 first exceeded Mach. 1 on October 14, 1947. Three X-1's were built. The first, which made the first supersonic flight at Mach. 1.06 on October 14, 1947, is now in the Smithsonian Museum, Washington, D.C. The second is being used by the NACA for high-speed flight research, while the third was destroyed on the ground at the Edwards A.F.B. during fueling operations.

X-1A. Similar to the X-1 but fitted with turbo-driven fuel pumps and increased fuel capacity. The fuselage is 5 feet (1.525 m.) longer and the pilot's windscreen is stepped up for better visibility. Cockpit is pressurised but not refrigerated. Jettisonable canopy and ejection seat. On December 12, 1953, Major Charles Yeager, who made the first supersonic flight in the X-1, flew the X-1A at a speed of 1,650 m.p.h. (2,640 km.h.) at an altitude of about 70,000 ft. (21,350 m.). In May, 1954, Major A Murray, U.S.A.F., reached a reported height of 90,000 ft. (27,450 m.) in the X-1A.

In 1955 the X-1A was fitted with new wing panels with a thickness/chord ratio of 4% instead of 10%, an aspect ratio of 4 instead of 6, but with the same gross area. Just before the X-1A was due to be released from its B-29 carrier on its first flight with the new wings in August, 1955, an explosion made it necessary for the X-1A to be jettisoned from 30,000 ft. (9,150 m.) and it was completely destroyed.

X-1B. Similar to X-1A but is intended primarily for research on thermal problems encountered in high-speed flight and is specially equipped and instrumented for this purpose.

X-1C. Project cancelled by the U.S. A.F.

X-1D. Similar to X-1A. Destroyed in August, 1951, when it was jettisoned from its B-50 carrier over the Edwards A.F.B. following an explosion. There were no casualties.

A full structural description of the X-1 has been published in previous issues of "All the World's Aircraft."

Dimensions (X-1A and X-1B).—
Span 28 ft. (8.54 m.).
Length 35 ft. 7 in. (10.85 m.).
Height 10 ft. 8 in. (3.25 m.).

THE BELL X-2.

The X-2 is a swept-wing rocket-powered research aircraft which has been developed jointly by Bell, the U.S.A.F. and the N.A.C.A. to explore the problems of transonic and supersonic flight.

The aircraft has stainless steel wings and tail, a K-monel metal fuselage and is powered by a Curtiss-Wright rocket motor, the first of its type to be fitted with throttle control.

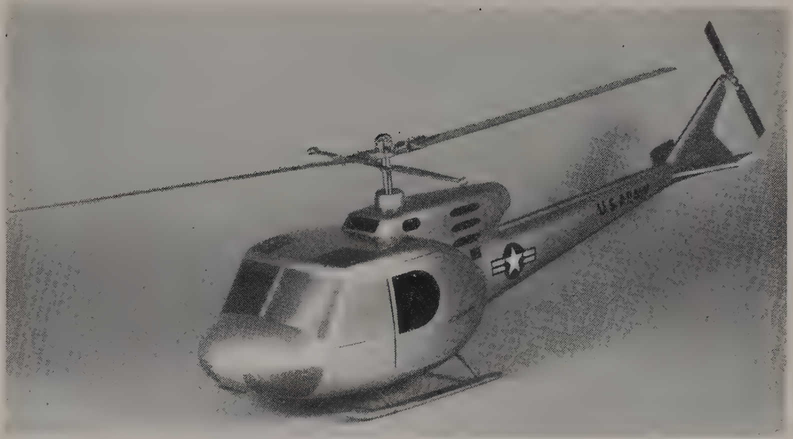
A flat skid landing-gear permits additional fuel to be carried in the space ordinarily occupied by wheels and retracting gear.

The pilot's cockpit is heavily insulated and pressurised, and is detachable. In an emergency at high altitude the entire cockpit could be separated from the rest of the aircraft by explosive charges and a ribbon parachute would carry it to a lower altitude where the pilot could make a normal bale-out.

An unpowered X-2 was lost in May, 1954, when it was jettisoned from its B-50 carrier after being damaged by an explosion in the B-50.

The second X-2 was expected to make its first powered flight before the end of 1955. It will be carried to altitude under a specially-equipped B-50 carrier.

No further details are available.



A model of the Bell XH-40 Utility Helicopter.

THE BELL MODEL 212.

U.S. Army designation : XH-40.

In 1955 Bell won an Army Competition for the development of a utility helicopter to be suitable for front-line evacuation of casualties, general utility missions and as an instrument trainer.

The winning design provides for a lightweight single-rotor cabin craft capable of carrying a payload of 800 lb. (363 kg.). It will have a speed of 115 m.p.h. (184 km.h.) and a rate of climb of 1,500 ft./min. (460 m./min.).

The XH-40 will be powered by a Lycoming XT53 free power shaft turbine which will develop 825 s.h.p.

No further details are available.

THE BELL MODEL 200.

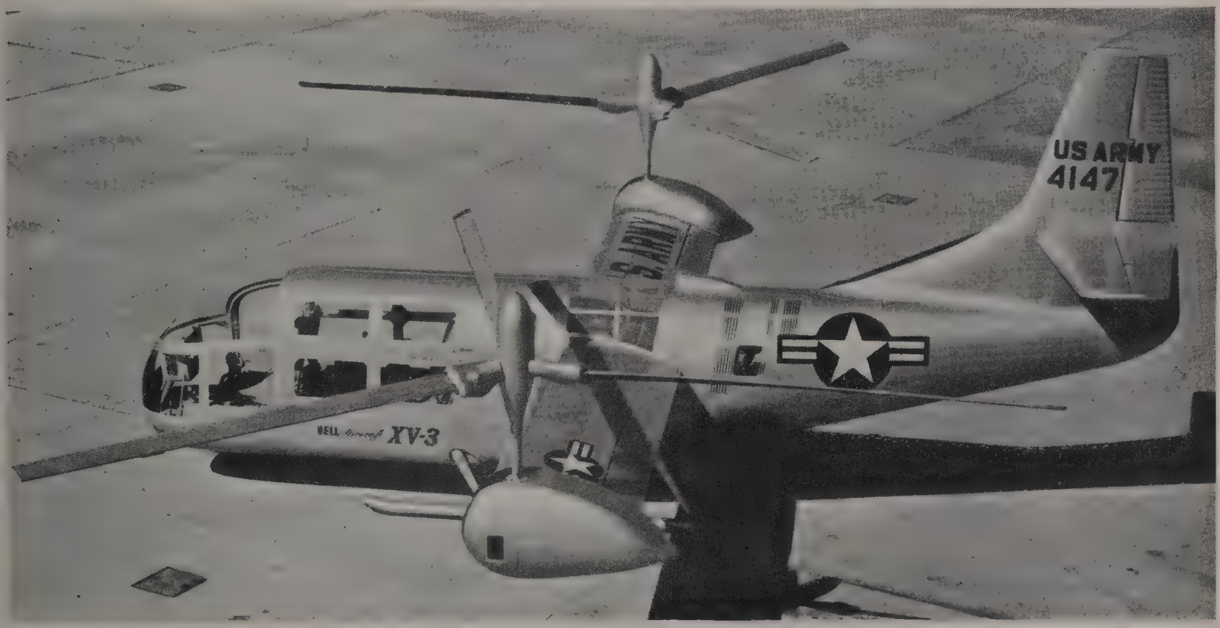
U.S. Army designation: XV-3.

The XV-3 is an experimental convertiplane which has been developed by Bell and the U.S.A.F. Research and Development Command for the U.S. Army under a joint Army-Air Force contract.

The XV-3 convertiplane is of the tilting-rotor type and combines the features of both the helicopter and the aeroplane.

Two three-blade combination rotor/propellers, mounted near the tips of the fixed wing, operate as conventional lifting rotors during take-off, landing and low-speed flight and as aircraft propellers for horizontal cruise and high-speed flight.

The tilting of the rotors is by electric motors enclosed in fairings at the wing tips and their movement through their full range from horizontal to vertical altitudes can be accomplished in from 10 to 15 seconds. The pilot can stop or reverse the conversion at any point, steady stable flight being maintained with the rotor/propellers in any intermediate position.



The Bell XV-3 Convertiplane (450 h.p. Pratt & Whitney R-985 engine).

Power is supplied by a Pratt & Whitney R-985 engine located behind the cabin, which seats four. An improved version of the Bell helicopter-type skid landing-gear is fitted.

As a helicopter, the XV-3 will be capable of hovering or flying forward, backward or sideways, and will be able to operate into and out of confined areas. As an aeroplane the XV-3 will operate as a medium-range aircraft with an estimated speed of more than 175 m.p.h. (280 km.h.).

The X-3 made its first vertical flight on August 23, 1955.

Dimensions.—
Diameter of rotors 24 ft. (7.32 m.).
Span of fixed wings 30 ft. (9.15 m.).
Length of fuselage 30 ft. (9.15 m.).
Height 13 ft. (3.96 m.).

THE BELL VTOL.

The Bell VTOL (Vertical Take-off and Landing) is an experimental jet-propelled vertical-rising winged aircraft which uses two jet engines to provide thrust for both vertical and horizontal flight. Two Fairchild J44 turbojet engines, each rated at 1,000 lb. (454 kg.) s.t., are mounted alongside the fuselage, one on each side, and can be rotated through 90 degrees from a vertical position for take-off and landing to a horizontal position for forward level flight.

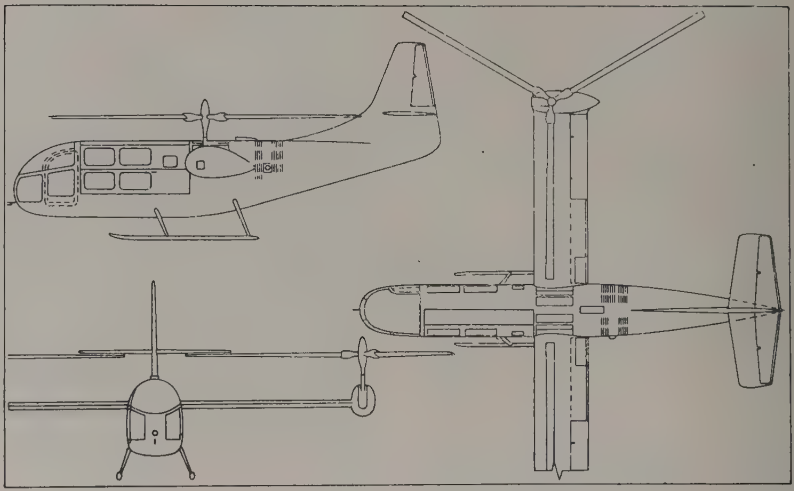
For take-off and low-speed flight compressed air supplied by a turbo-compressor is ejected from nozzles at the wing-tips and tail to provide pitch, yaw and roll control. When sufficient forward speed is attained, flight control is provided by conventional ailerons, rudder and elevators.

The VTOL is a private-venture test vehicle which has been built up from a number of readily available components, including a glider fuselage, a commercial lightplane wing and a helicopter landing-gear, so that it could be completed as quickly and as cheaply as possible to prove the theory of vertical take-off. The two Fairchild engines were obtained on loan from the U.S.A.F.

The first free vertical flight was made on November 16, 1954, but up to the time of writing no transitions from vertical to horizontal flight by swivelling of the engines had been accomplished.

Dimensions.—
Span 26 ft. (7.93 m.).
Length 21 ft. (6.40 m.).

Weight.—
About 2,000 lb. (908 kg.).



The Bell XV-3 Convertiplane.

The Bell VTOL Test Vehicle in vertical flight.

THE BELL MODEL 47G HELICOPTER.

U.S.A.F. designation: H-13.
U.S. Navy designation: HTL.

Since it delivered its first Model 47 in January, 1947, Bell has produced five commercial models. They are the 47B, which had an enclosed, automobile-type cabin; the 47B-3, which had an open cockpit; the 47D, which had an all-Plexiglas cabin for greater visibility, plus weather protection, the 47D-1, and the 47G, the company's newest model. There have been corresponding military and naval versions to most of these models.

Since the delivery of the first commercial Model 47 in December, 1946, more than 1,500 Bell helicopters have been bought by the U.S. armed forces and by commercial operators in the United States and abroad.

Bell commercial helicopters have been used effectively to dust and spray agricultural crops for weed and pest control, to conduct power-line, forestry, pipe-line, geological and geophysical surveys, to aid in fighting forest fires, to carry airmail and to fulfil a variety of other aerial tasks for which they are especially suited.

The latest version of the Model 47 is the 47G. This model has several improvements, including a small elevator which is geared to work in conjunction with rotor tilt. This permits an increase in permissible C.G. travel and greatly improves stability.

The following are the current military versions of the 47G :—

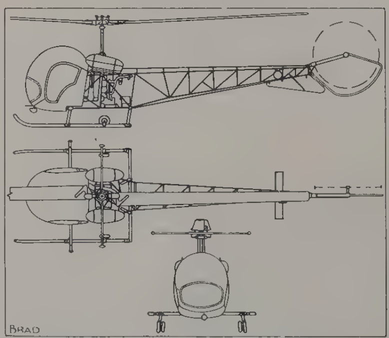
XH-13F. This is an experimental craft powered by a 280 h.p. Turbomeca Artouste shaft turbine engine.

H-13G. Lycoming VO-435 engine derated to 200 h.p. This permits maximum power to be maintained to 5,000 ft. (1,525 m.). Otherwise as basic 47G.

HTL-6. Naval training version of 47G. All supplied with skid landing-gear but float kits provided for proportion.

Type.—Three-seat General Utility Helicopter.

Rotors.—Two-blade main rotor and controllable-pitch anti-torque rotor. Main rotor hub mounted on transmission mast by universal joint and provided



The Bell Model 47G Helicopter.

The Bell Model 47G Helicopter with flotation gear.

The Bell Model 47G Helicopter fitted with external panniers.

with a stabilizing bar below and at right angles to the blades. A swash-plate revolving with the mast but free to move up and down provides cyclic pitch-control. Lower half of swash-plate which does not revolve alters pitch of the blades differentially for directional control. Main rotor drive through a centrifugal clutch and a two-stage planetary transmisson with a 9 : 1 reduction ratio. Free-wheeling mechanism incorporated in transmission. Transmission furnishes power take-offs for tail rotor drive, cooling fan and accessories and pulleys. Main rotor blades of symmetrical aerofoil section, are of laminated wood with a steel insert in leading-edge for strength and mass-balance. Blade area (each) 17.67 sq. ft. (1.64 m.^{2}). Disc area 965 sq. ft. (89.65 m.^{2}). Pre-coning angle 2.5 degrees. Metal anti-torque rotor blades. Blade area (each) 1.2 sq. ft. (0.11 m.^{2}). Disc area 25.31 sq. ft. (2.35 m.^{2}).

Fuselage.—In three sections ; centre, tail and cabin. Centre section has a welded tubular steel framework which provides for mounting the engine and supports the cabin. Rear section is also a tubular structure, is triangular in cross-section and serves as a support for the anti-torque rotor drive-shaft. Small synchronised elevator surface at rear end of fuselage responds to the fore and aft motion of the cyclic-pitch control provides better stability and allows a greatly increased C.G. travel.

Landing Gear.—Tubular skid type. Skid tread 7 ft. 6 in. (2.28 m.). Small ground handling wheels and tie-down and towing attachments provided. Four-wheel landing-gear may be supplied for training and other missions requiring considerable handling. The two forward self-castoring wheels capable of swivelling through 360°, the two rear wheels fixed. Wheel track 5 ft. 10½ in. (1.78 m.). For amphibious use two air-inflated nylon floats are easily attached.

Power Plant.—One vertically-mounted 200 h.p. Franklin 6V4-200-C32AB (0-355-5) six-cylinder horizontally-opposed fan-cooled engine with clutch, drive shaft and rotor assembly in an integral unit in a steel-tube framework with the engine supported in rubber mounts at the top and bottom and attached to the welded framework of the forward fuselage. The engine-mounting structure has three attachment points for the rear fuselage. Engine controls include throttle, carburettor, hot air and carburettor mixture. The throttle is located on the main rotor pitch control lever and drives through a cam which automatically compensates for varying power requirements as the main rotor pitch control lever is actuated. Two interconnected saddle-mounted fuel tanks (43 U.S. gallons = 172.5 litres total capacity) on C.G. and with gravity feed.

Accommodation.—Side-by-side seating for three in enclosed compartment. The compartment is covered by a full-blown Plexiglas canopy with doors attached. For fair weather or specialised operations the doors are quickly removable.

Controls.—Conventional control stick for tilting main rotor by cyclic rotor blade angle change. Adjustable friction device on stick used to regulate control sensitivity. Main rotor pitch control lever located at left side of each seat. Rudder pedals connected to pitch-changing mechanism on tail rotor for torque compensation and directional control.

Equipment.—Standard equipment includes complete VFR flight and engine instruments, hydraulic boost control, 28-volt/50 amp. generator, electric starter, ground handling wheels, heavy-duty battery, etc. Additional accessories available in CAA-approved kits include floats, night flying equipment, dusting and spraying equipment, cargo carriers, dual controls, etc.

Dimensions.—

Diameter of main rotor 35 ft. 1½ in. (10.72 m.).

Overall length (main rotor fore-and-aft) 41 ft. 2½ in. (12.58 m.).

Length of fuselage (tail rotor vertical) 27 ft. 4 in. (8.33 m.).

Width (over torsion bar) 8 ft. 6 in. (2.59 m.).

Height 9 ft. 6 in. (2.89 m.).

Diameter of tail rotor 5 ft. 8 in. (1.72 m.).

The Experimental XH-13F, which is powered by a Turbomeca Artouste shaft turbine.

Weights.—

Weight empty (standard 2 or 3 seater) 1,410 lb. (640 kg.).

Max. certificated weight 2,350 lb. (1,067 kg.).

Performance (at 2,200 lb. = 1,000 kg. A.U.W.).—

Max. allowable speed 100 m.p.h. (160 km.h.).

Cruising speed 80 m.p.h. (128 km.h.).

Max. rate of climb at S/L. 910 ft./min. (277 m./min.).

The Bell Model 47H Helicopter, a new de-luxe version of the Model 47G.

The Bell Model 47J (220 h.p. Lycoming O-435 engine), a four-seat development of the Model 47G.

Time to 5,000 ft. (1,525 m.) 7 min.
Service ceiling 12,200 ft. (3,720 m.).
Absolute ceiling 13,700 ft. (4,180 m.).
Hovering ceiling in ground effect 5,600 ft. (1,710 m.).
Range 225 miles (360 km.).
Endurance 3.9 hours.

THE BELL MODEL 47H HELICOPTER.

The Model 47H is a de-luxe version of the 47G. It has an enclosed sound-proofed cabin 60 in. (1.525 m.) wide which can accommodate a pilot and two passengers on an automobile type cross seat. Interior appointments include leather upholstery throughout and a leather-covered instrument console grouping all electrical switches and carburetter controls to the left of the pilot. A metal monocoque tail-boom contains a baggage compartment large enough to carry luggage for all occupants.

The rotor-system, power-plant, hydraulic boost control and synchronised elevator are the same as for the Model 47G.

Dimensions.—
As for Model 47G.
Weights.—
Weight empty 1,485 lb. (674 kg.),
Weight loaded 2,350 lb. (1,067 kg.).
Performance.—
Max. speed over 100 m.p.h. (160 km.h.).
Cruising speed approx. 95 m.p.h. (152 km.h.).
Rate of climb 830 ft./min, (253 m./min.).
Hovering ceiling in ground effect 5,000 ft. (1,525 m.).
Absolute ceiling 14,800 ft. (4,520 m.).
Normal range over 200 miles (320 km.),

THE BELL MODEL 47J HELICOPTER.

U.S. Navy designation : HUL-1.

The Model 47J is a four-seat utility version of the 47G. The enclosed cabin seats the pilot centrally in front, with three passengers on a cross bench aft. The passenger seat can be removed to allow for the installation of two stretchers on a parallelogram rack such as is used in typical Army field ambulances, plus a jump seat for a medical attendant ; with the port door removed a trap can be raised to permit use of an internal electrically-powered hoist for rescue work ; or the passenger seat can be folded back to leave clear space for up to 600 lb. (272 kg.) of cargo. Conversion to any of the cabin configurations can be made in the field in a matter of minutes without the use of tools.

The 47J is powered by a Lycoming O-435 engine de-rated to develop a maximum of 220 h.p.

Dimensions.—
As for Model 47G.
Weights.—
Weight empty 1,649 lb. (749 kg.).
Weight loaded 2,550 lb. (1,158 kg.).
Performance.—
Max. speed over 110 m.p.h. (176 km.h.).
Cruising speed 95-100 m.p.h. (152.140 km.h.).
Normal range over 200 miles (320 km.).

THE BELL MODEL 61.

U.S. Navy designation: HSL-1.

The HSL-1 is a large tandem-rotored helicopter which has been designed specifically for anti-submarine warfare. It is in production for the U.S. Navy, and several HSL's have been ordered by the Royal Navy.

The tandem-rotored HSL-1 marks the Bell company's first departure from its familiar single-rotor configuration which has been used in all Bell helicopters since 1942. Each of the two rotors incorporates the basic Bell rotor principles, characterised by the rigid two-blade rotor and automatic stabilising bar. The fore and aft rotors are interconnected and power is supplied by a Pratt & Whitney R-2800 engine in a buried installation. The rotors can be folded to enable the helicopter to negotiate the elevators in aircraft-carriers or other type of ship.

The HSL-1 is equipped with the latest dipping sonar for submarine detection

The Bell HSL-I Anti-submarine Helicopter (Pratt & Whitney R-2800 engine).

and is armed with lightweight homing weapons for the destruction of undersea craft. A Bell-developed helicopter auto-pilot permits the HSL-1 to hover motionless for long periods during a search operation.

In its current production form, the HSL-1 carries crew of four, a pilot, co-pilot and two sonar operators. It has a flight endurance of nearly four hours.

DIMENSIONS.—
Rotor diameter (both) 51 ft. 6 in. (15.7 m.).
Length of fuselage 39 ft. 2⅜ in. (11.9 m.).
Overall height (over rear rotor pylon) 14 ft. 6 in. (4.4 m.).
Width (rotors folded) 11 ft. 8½ in. (3.5 m.).

WEIGHTS AND PERFORMANCE.—
No data available.

BELLANCA

BELLANCA AIRCRAFT CORPORATION.

HEAD OFFICE, WORKS AND AERODROME: BELLANCA AIRPORT, NEW CASTLE, DELAWARE.

Established: December 30, 1927.

Chairman of the Board: John Charles Redmond.

President: Sidney Albert.

Executive Engineer: Bruno J. Salvadori.

Secretary: Walter E. Joyce.

Treasurer: A. K. Rothchild.

The Bellanca Aircraft Corporation was incorporated on December 30, 1927, taking over the old Bellanca Aircraft Corporation of America.

Since the war the Bellanca company has built the Model 14-13-3 Cruisair and the Model 14-19 Cruisemaster, both four-seat cabin monoplanes of conventional low-wing design. They have both been fully described and illustrated in previous editions of "All the World's Aircraft."

The company is at present devoting its principle activities to research in, and the design and manufacture of classified high-speed towed targets and drones, and to the manufacture of primary parts and components under sub-contract to other companies engaged in the defence industries. It is contemplating resuming the manufacture of the Model 14-19, referred to above.

BOEING

THE BOEING AIRPLANE COMPANY.

HEAD OFFICE: SEATTLE 14, WASH.

AIRCRAFT MANUFACTURING DIVISIONS: SEATTLE, WASH., AND WICHITA, KANSAS.

Established: July, 1916.

Chairman: C. L. Egtvedt.

President: William M. Allen.

Senior Vice-President: Wellwood E. Beall.

Vice-President in charge of Engineering: Edward C. Wells.

Vice-President in charge of Manufacturing: F. P. Laudan.

Vice-President in charge of Industrial Relations: A. F. Logan.

Vice-President in charge of Finance: J. O. Yeasting.

Vice-President in charge of Administration and Secretary: J. E. Prince.

Vice-President and Eastern Representative: J. P. Murray.

Controller: Clyde Skeen.

Chief Engineer: George C. Martin.

Director, Pilotless Aircraft: Lysle A. Wood.

WICHITA DIVISION.

Vice-President and General Manager: J. E. Schaefer.

Vice-President in charge of Manufacturing: C. B. Gracey.

Assistant to Vice-President and General Manager: L. M. Divinia.

Chief Engineer: N. D. Showalter.

In 1955 the Boeing Airplane Company was engaged in production of the B-47 Stratojet six-jet bomber; the KC-97 stratofreighter military tanker-transport; the B-52 eight-jet heavy bomber; and the KC-135 Stratotanker jet tanker-transport.

The KC-135, which is a developed version of the Model 707, will be the standard aerial tanker for the B-52 wings of the U.S.A.F. Strategic Air Command.

The company is now well advanced in its programme for the production of an undisclosed quantity of B-52's at Seattle, and the first production Stratofortress B-52A, was rolled out of the factory at Seattle on March 18, 1954. B-52's are also in production at the Boeing plant at Wichita, Kansas. It is expected that the B-52 will be going into service in appreciable numbers in the Strategic Air Command in 1956.

The B-47, for which large production contracts are in hand, is being manufactured at Boeing's Wichita Division plants, where its production is the subject of one of the most widespread sub-contracting programmes in the American rearmament effort. More than 1,000 B-47's had been built in Wichita by the end of 1954.

Both the Douglas Aircraft Company and the Lockheed Aircraft Corporation are producing the Boeing B-47 in government-owned plants, the former at Tulsa, Oklahoma, and the latter at Marietta, Georgia.

The KC-97 continued in production in the government-owned and Boeing-operated plant at Renton, near Seattle. The 500th Stratofreighter produced, a KC-97G, was delivered to the U.S.A.F. on March 5, 1954. All KC-97's now being manufactured are equipped with the Boeing "Flying-Boom" for aerial re-fueling.

Boeing's guided missile programme is large and important. A Pilotless Aircraft Division was formed early in 1953 under the former chief engineer Lysle A. Wood, who became Director—Pilotless Aircraft. No details of pilotless aircraft activity have been made public, other than that the company is engaged in development of the IM-99 Bomarc supersonic interceptor missile, which is powered by two Marquardt ramjets.

Boeing has been awarded an Air Force contract for an "engineering study of the application of nuclear power-plants to aircraft." Under the contract Boeing is working in close co-operation with Pratt & Whitney Aircraft. No further details are available for publication.

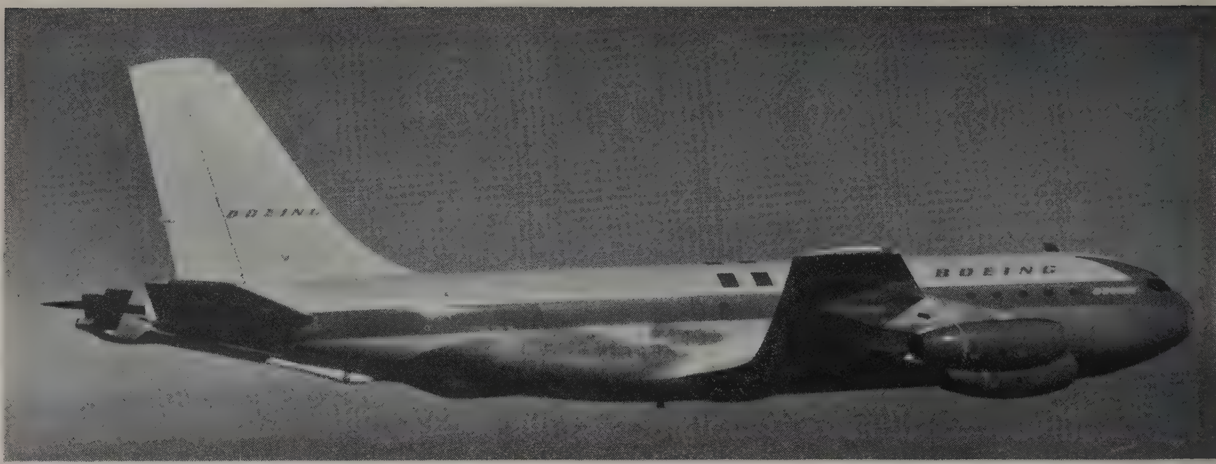
At the beginning of 1955, employment at the various Boeing plants totaled 66,482.

THE BOEING MODEL 707.

The Boeing Model 707 was the first American jet transport to be completed and flown. It made its first flight on July 15, 1954.

The Model 707 was built as a private venture, primarily as a demonstrator tanker-transport which, in developed form

The Boeing Model 707 prototype Tanker-Transport (four Pratt & Whitney JT3L turbojet engines).



The Boeing Model 707, here seen fitted with the Boeing "Flying Boom" in-flight refueling equipment.

would be able to refuel present and future jet bombers, fighters and reconnaissance aircraft at or near their operational altitudes and speeds. It represented a private investment by Boeing of more than 15 million dollars.

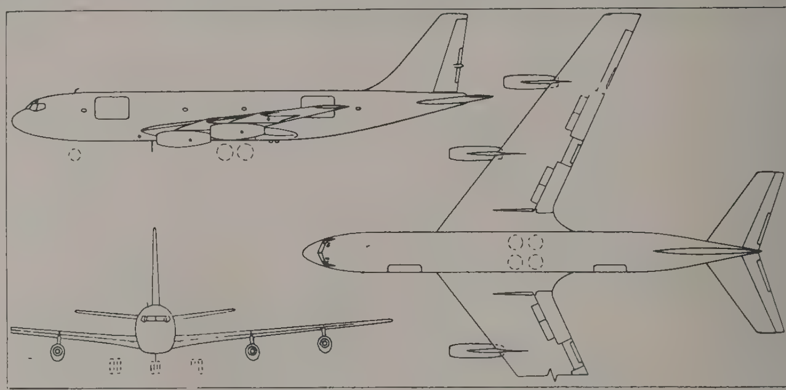
The prototype is fitted with two large cargo doors, forward and aft of the wings, together with provisions for the installation of cargo tie-down fittings and aerial fuelling equipment. In commercial form, such an aircraft would be capable of carrying from 80 to 130 passengers and would make possible regular non-stop trans-continental passenger schedules of less than five hours; and New York-London passenger flights in less than seven hours.

In August, 1954, it was announced that Boeing had received a production contract from the U.S.A.F. for an advanced tanker-transport version of the 707, which will carry the designation KC-135. Substantial additional orders were announced in March, 1955. The total value of orders placed and to be placed for the KC-135 will be approximately $700 million. The KC-135 was ordered into production on September 1, 1954.

The description below refers specifically to the Model 707 prototype.

Type.—Four-jet Tanker-Transport.

Wings.—Swept-wing cantilever monoplane. 35° sweepback at 25% of chord. Chord 28 ft. (8.5 m.) at root, 9 ft. 4 in. (2.8 m.) at tip. Dihedral 7°. All-metal two-spar structure. Centre-section continuous through fuselage. Two double-slotted flaps on each wing panel. Lateral control by mid-span high-speed ailerons, supplemented by hydraulically-operated spoilers on upper wing surfaces, and when flaps are down by outboard low-speed ailerons. Spoilers may be used symmetrically as speed brakes. Gross wing area 2,400 sq. ft. (223 m.²).



The Boeing Model 707 prototype Tanker-Transport.

Fuselage.—All-metal structure with cross section made up of two circular arcs of different radii, the larger above, faired into smooth-contoured ellipse. Maximum width of fuselage 132 in. (3.35 m.). Maximum height of fuselage 164 in. (4.15 m.).

Tail Unit.—Cantilever monoplane type. All-metal structure. Span of tail 39 ft. 8 in. (12.0 m.).

Landing Gear.—Retractable tricycle type. Hydraulic actuation. Main units are four-wheel bogies and retract inwardly into underside of thickened wing root and fuselage. Dual nose-wheel unit retracts forward into fuselage. Wheelbase (between centre-lines of shock struts) 44 ft. (13.4 m.). Track (between centre-lines of shock struts) 21 ft. (6.4 m.).

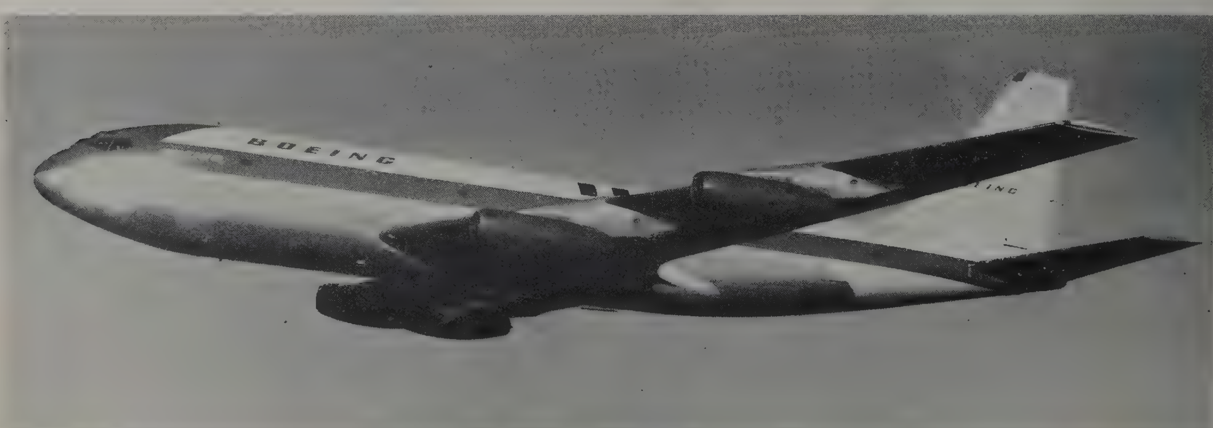
Power Plant.—Four Pratt & Whitney JT-3 turbojet engines (10,000 lb.=4,540 kg. s.t. each) in four separate and interchangeable pods, two under each wing, with centre-lines at 26 ft. 3 in. (8.0 m.) and 45 ft. 3 in. (13.8 m.) respectively from fuselage centre-line. Inboard nacelle centre-line 5 ft. 7 in. (1.70 m.) from ground, outboard nacelle centre-line 7 ft. 10 in. (2.38 m.) from ground. All fuel carried within wings in integral interspar compartments accessible through manhole openings in under wing surface.

Accommodation.—Flight compartment in nose seating pilot and co-pilot side-by-side. Flight engineer's station on starboard side behind co-pilot. Main cabin 90 ft. (27.4 m.) long and free of structural obstructions. Further space for cargo, tankage, etc., below cabin floor.

Dimensions.—
Span 129 ft. 8 in. (39.5 m.).
Length 127 ft. 10 in. (38.9 m.).
Height (on wheels and over tail) 38 ft. 3 in. (11.6 m.).
Height (from ground to top of fuselage) 17 ft. 7 in. (5.3 m.).

Weights (Designed).—
Tare weight 88,890 lb. (40,356 kg.).
Weight empty equipped 92,120 lb. (41,822 kg.).
Payload 25,000 lb. (11,350 kg.).
Weight loaded 190,000 lb. (86,260 kg.).

Performance.—
Cruising speed 550 m.p.h. (880 km.h.).



The Boeing Model 707 prototype Tanker-Transport (four Pratt & Whitney J57 turbojet engines).

The Boeing B-52A Stratofortress Heavy Bomber (eight Pratt & Whitney J57 turbojet engines).

THE BOEING STRATOFORTRESS.

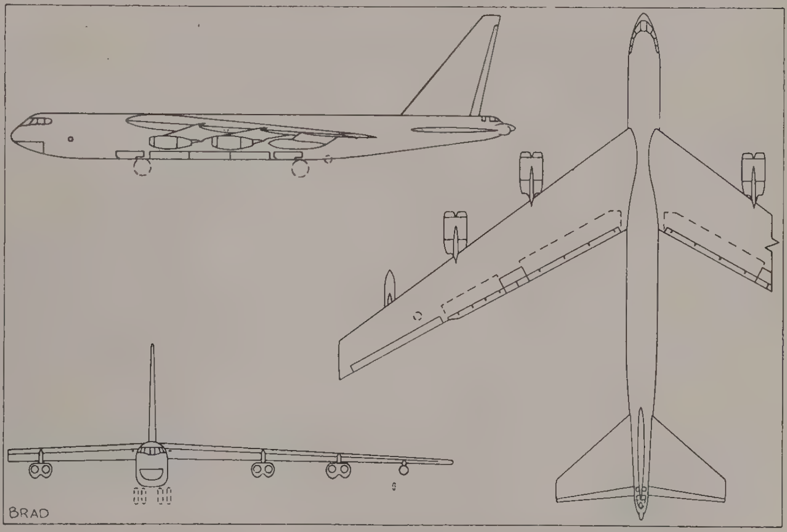
U.S. Air Force designation: B-52.

The B-52 is an eight-jet swept-wing long-range heavy bomber which has been ordered into production for the U.S.A.F. and is in quantity production at the Seattle and Wichita plants.

Two prototypes, the XB-52 and YB-52, were built, the YB-52 flying for the first time on April 15, 1952, while the XB-52 made its maiden flight on October 2, 1952.

Although the B-52 is a completely different aircraft from the B-47 insofar as both design and mission are concerned, outwardly the two aeroplanes are somewhat similar in appearance. Both feature a 35-degree angle of wing sweepback, distinctive Boeing-type external jet engine pods and a tandem landing-gear. The B-52 landing-gear is, however, a double side-by-side tandem, with small single outrigged wing-tip "protection" wheels which do not normally come into contact with the ground. In production aircraft the main gear is of the "cross-wind" landing type.

The B-52 is powered by eight Pratt &



The Boeing B-52A Stratofortress Heavy Bomber.

The Boeing B-52A Stratofortress Heavy Bomber (eight Pratt & Whitney J57 turbojet engines).

The Boeing B-47B Medium Bomber (six General Electric J47 turbojet engines).

Whitney J57-P-1 turbojet engines (over 10,000 lb.=4,540 kg. s.t. each) which are mounted in pairs in four nacelles on forwardly-inclined cantilever struts under the wings.

The production B-52A has, compared with the two prototypes, a redesigned nose and crew compartment, the latter with side-by-side seating for the pilot and co-pilot. It also has auxiliary fuel tanks under the outer wings. The first production B-52A flew for the first time on August 5, 1954.

A crew of six is carried. All crew members are provided with means of emergency escape, three being ejected upwards, two downwards, while the tail-gunner is ejected complete with tail turret.

Production contracts have also been placed for B-52B, B-52C and B-52D models but no details of these versions are available.

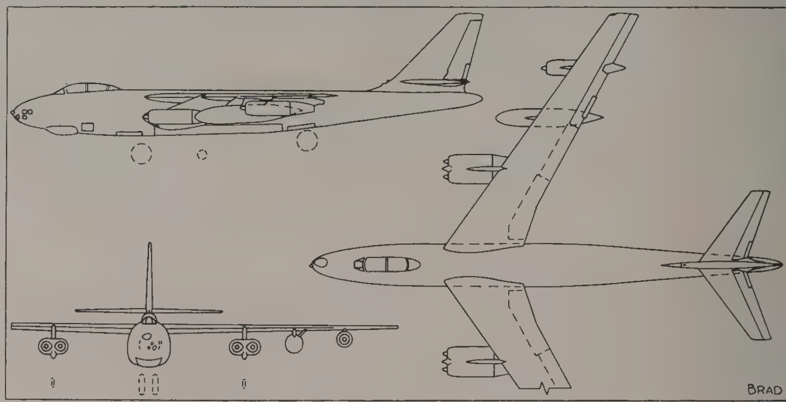
A long-range strategic reconnaissance version known as the RB-52B is also being built.

All other details of the B-52 are classified.

DIMENSIONS.—
Span 185 ft. (56.42 m.).
Length 156 ft. 6 in. (47.73 m.).
Height over tail 48 ft. $3\frac{1}{2}$ in. (14.73 m.).

WEIGHT.—
Weight loaded over 350,000 lb. (158,900 kg.).

PERFORMANCE.—
Max. speed over 600 m.p.h. (960 km.h.).
Service ceiling over 50,000 ft. (15,250 m.).



The Boeing B-47B Stratojet Medium Bomber.

THE BOEING STRATOJET.

U.S. Air Force designation : B-47.

The XB-47 was the first large jet-propelled aircraft to be fitted with sweptback wings and tail surfaces. Two prototypes were built, the first flying for the first time on December 17, 1947.

XB-47. Two prototypes, both originally fitted with General Electric J35 engines (4,000 lb.=1,816 kg.). In 1949 first prototype re-engined with J47 engines (5,200 lb.=2,360 kg. s.t.). Re-engined XB-47 flew for first time on October 7, 1949.

B-47A. Six General Electric J47-GE-11 engines (5,200 lb.=2,360 kg. s.t.). 18 individual Jato solid-fuel rockets fitted to give emergency take-off thrust of 20,000 lb. (9,080 kg.). First production B-47A flew for the first time on June 25, 1950.

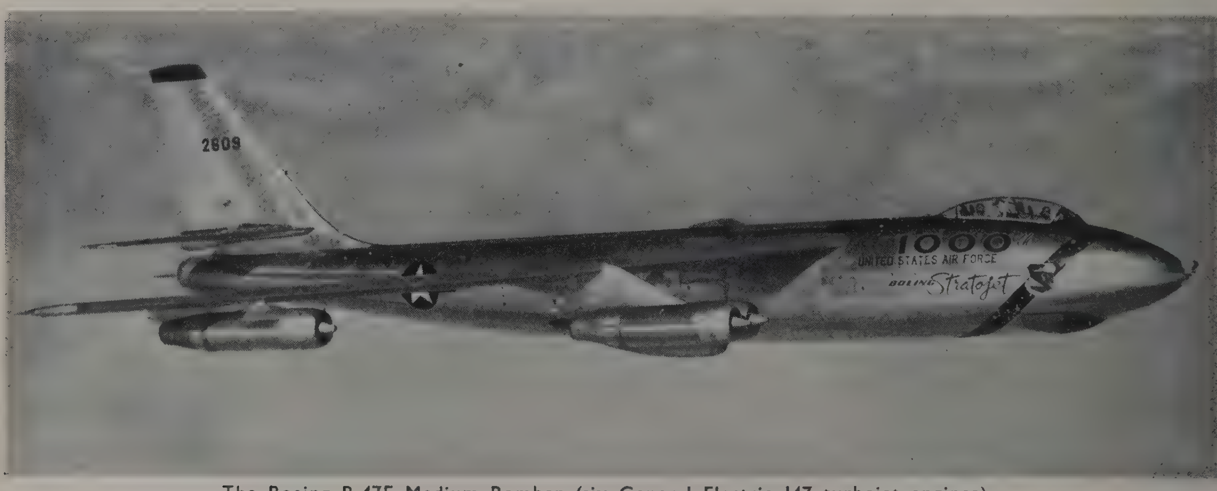
B-47B. Six General Electric J47-GE-23 engines (5,800 lb.=2,630 kg. s.t.). Gross weight 185,000 lb. (84,000 kg.). Fitted with wing drop tanks. First B-47B flew on April 26, 1951. B-47B's are being modified and modernised up to B-47E standard by Boeing-Wichita. Modifications include installation J47-GE-25 engines and water-injection system to give 17% increased T.O. power; substitution of droppable 33-rocket T.O. assist for original internal 18-rocket equipment; installation of 16-foot approach parachutes; installation of injection seats (pilot and co-pilot up, navigator down); re-arrangement of equipment in flight compartment and substitution of G.E. radar-directed tail gun-turret armed with two 20 mm. cannon for former .50-cal. guns. Modernisation programme, which began late in 1954, will be under way for eighteen months.

KB-47F. Tanker modification of B-47B. Uses an adaptation of Flight Refuelling "probe-and-drogue" system installed in bomb-bay. Still under test by U.S.A.F.

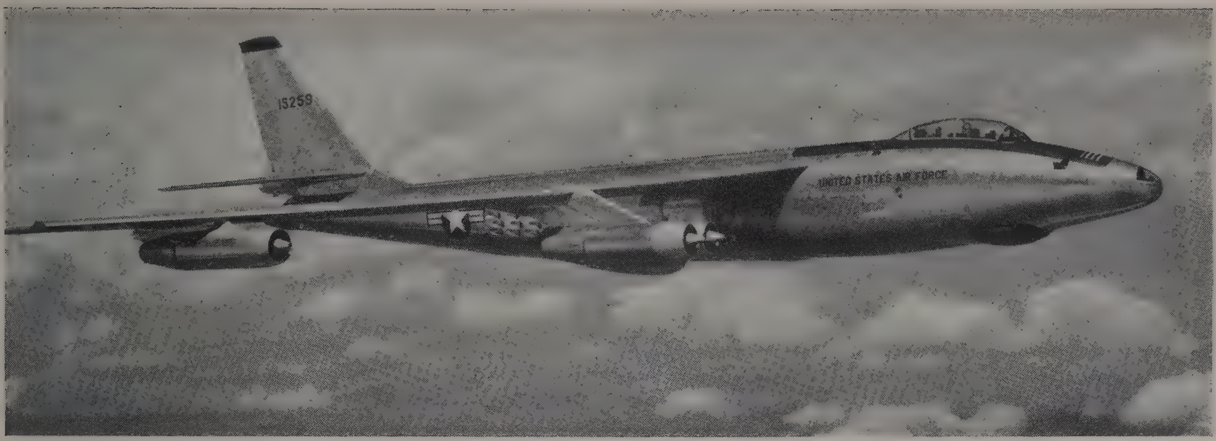
RB-47F. Conversion of B-47B for high-altitude photographic reconnaissance. Eight cameras and equipment in heated "package" can be installed in and removed from bomb-bay.

XB-47C. Research aircraft which was to have been fitted with four Allison J71 engines. Project cancelled.

XB-47D. A B-47B modified to serve as a test-bed for the Wright T49 turboprop engine. Two T49 engines are installed in place of the two pairs of J47 turbojets in the inboard pod positions. Will be used to test feasability of high-speed long-range composite bombers using both turbojet and turboprop power.



The Boeing B-47E Medium Bomber (six General Electric J47 turbojet engines).



The Boeing RB-47E Long-range Reconnaissance Monoplane (six General Electric J47 turbojet engines).

B-47E. Six General Electric J47-GE-25 engines (6,000 lb.=2,724 kg. s.t.). Developed version of B-47B. Remotely-controlled tail armament of two 20 mm. cannon. First B-47E flew on January 30, 1953. The 1,000th Stratojet, a B-47E, was delivered to the U.S.A.F. on December 17, 1954.

RB-47E. Day or night long-range photographic reconnaissance version of B-47E. In production at Wichita. Longer nose. Heated and air-conditioned camera compartment. Crew of three, pilot, co-pilot and photographer-navigator. First RB-47E flew on July 3, 1953. Length 109 ft. 10 in. (33.5 m.) other dimensions as for B-47E.

YB-47J. Modified bomber version fitted with MA-2 radar bomb-sight for training B-52 crews. Fifteen built.

The description which follows refers to the B-47E.

Type.—Six-jet Medium Bomber.

Wings.—Shoulder-wing cantilever monoplane with anhedral and 35 degree sweep-back. Thin laminar-flow wing section. All-metal stressed-skin structure.

Fuselage.—Oval-section all-metal structure with flush-riveted stressed-skin covering.

Tail Unit.—Cantilever monoplane type. All-surfaces swept-back. All-metal structure.

Landing Gear.—Retractable tandem type. Two main twin-wheel units in tandem retracting forward into fuselage fore and aft of bomb-bay. Small outrigger wheel units retract into inboard engine nacelles.

Power Plant.—Six General Electric J47 turbojet engines, four paired in two nacelles supported on forwardly-inclined cantilever struts under inner wings and two in single nacelles under outer wings near tips. Auxiliary take-off power provided by rocket motors on a collar type rack mounted beneath the fuselage. Thirty-three JATO units of 1,000 lb. (454 kg.) thrust each can be carried. Rack can be dropped after rocket power is expended. Water injection systems are fitted to engines in B-47E and RB-47E and are being installed in modernised B-47B's. All production B-47's have provision for flight re-fuelling, using Boeing "Flying Boom" system.

Accommodation.—Crew of three. Pilot and co-pilot in tandem under bubble-type canopy. Bombardier in nose. Ejection seats for all crew members, pilot and co-pilot ejected upwards and navigator downward under nose. Entire crew accommodation forward of wings pressurised and temperature-controlled.

Armament.—Remotely-controlled tail armament only. Consists of two 20 mm. cannon. No other details available. Designed internal bomb load 20,000 lb. (9,080 kg.).

Dimensions.—
Span 116 ft. (35.4 m.).
Length 107 ft. (32.6 m.).
Height (over tail) 28 ft. (8.5 m.).

Designed Loaded Weight.—
200,000 lb. (90,800 kg.).

Performance.—
Max. speed over 600 m.p.h. (960 km.h.).

THE BOEING STRATOCRUISER.

Stratocruisers are being operated by Pan American World Airways, Northwest Airlines and British Overseas Airways.

Pan American World Airways have modified their fleet of 27 Stratocruisers to obtain increased performance. The engines of all the 27 aircraft have been fitted with G.E. CH-10 turbo-superchargers, the slightly larger turbine wheels of which will permit the engines to develop another 50 h.p. each. Ten of these aircraft, operated by the company's Atlantic Division, have also been given increased fuel capacity in the outer wings to provide non-stop New York-London (or Paris) range, and are known by Pan American as "Super Stratocruisers." The remaining 17 aircraft, operated by the Pacific-Alaska Division, do not need the increased range.

Type.—Four-engined Airliner.

Wings.—Low-mid-wing cantilever monoplane. Boeing 117 aerofoil section. Aspect ratio 11.58. All-metal two-spar stressed-skin structure. Electrically-operated Fowler-type flaps. Built-in thermal anti-icing system. Gross wing area 1,769 sq. ft. (164.2 m.²).

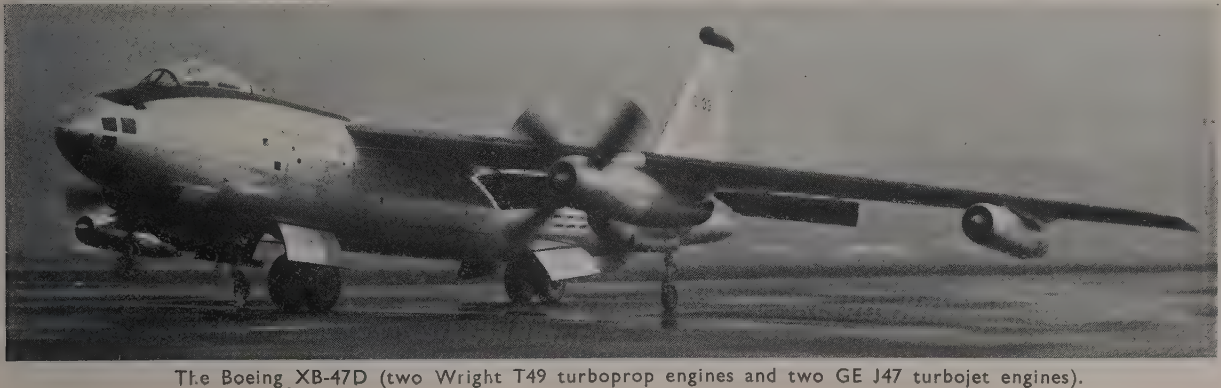
Fuselage.—All-metal semi-monocoque structure of inverted figure-8 cross-section designed for pressurization. Max. width of fuselage 11 ft. (3.35 m.). Max. depth 15 ft. 2½ in. (4.65 m.). Ground clearance 1 ft. 10½ in. (0.55 m.).

Tail Unit.—Cantilever monoplane type. Fixed surfaces of two-spar stressed-skin construction with built-in thermal anti-icing system. Rear portion of fin and the rudder are hinged to fold sideways for hangar stowage or servicing, the overall height over fin being so reduced by 12 ft. (3.6 m.). Movable surfaces have metal frames and fabric covering and are aerodynamically and mass-balanced. Trim-tabs in elevators and rudder. Hydraulically-operated power-boost system for rudder control. Tailplane span 43 ft. (13.1 m.).

Landing Gear.—Retractable tricycle type. All three units with dual wheels, main wheels 4 ft. 8 in. (1.42 m.) diameter, nose-wheels 3 ft. (0.915 m.) diameter. Electric retraction with emergency manual operation. Pedal-operated service brakes and hand-operated emergency brakes operated by separate hydraulic systems. Wheel track 28 ft. 5.6 in. (8.62 m.). Wheel base 36 ft. 1.16 in. (11 m.). Min. turning radius (approx.) 29 ft. (8.85 m.). Fuselage static position 2° nose-up.

Power Plant.—Four Pratt & Whitney R-4360 Wasp-Major twenty-eight-cylinder four-row radial air-cooled geared and turbo-supercharged engines each developing a maximum output of 2,800 h.p. and with a take-off output of 3,500 h.p. with water-injection. Curtiss Electric or Hamilton Standard four-blade constant-speed full-feathering and braking airscrews 16 ft. 8 in. (5 m.) in diameter. All four engine nacelles quickly detachable and interchangeable. Five groups of seven nylon bladder-type fuel cells in wings, with total capacity of 7,790 U.S. gallons (29,450 litres). Pan American "Super Stratocruisers" have an additional 410 U.S. gallons (1,550 litres) in cells in outboard wing sections.

Accommodation.—Two-deck fuselage, the upper deck accommodating the control cabin and the main passenger compartment and the lower deck a passenger lounge and two cargo holds. Control cabin in nose seats two pilots side-by-side with dual controls, navigator, engineer and radio operator. Various arrangements and furnishings of main upper deck passenger com-



The Boeing XB-47D (two Wright T49 turboprop engines and two GE J47 turbojet engines).

A Boeing Stratocruiser (four 2,800 Pratt & Whitney R 4360 Wasp Major engines) in B.O.A.C. colours.

partment permit seating for from 55 to 100 passengers. Standard arrangement accommodates a total of 81 passengers, 67 in main compartment and 14 in lower deck lounge. Circular stairway interconnects the two compartments. Main cabin entrance on port-side aft on upper deck level. Lower rear cargo door with built-in steps may be used to give access to main cabin *via* lounge stairway. In a sleeper version main cabin may be fitted with 28 upper and lower berths plus 5 seats, in addition to 14 seats in lounge. Fully-equipped galley with electric ovens, refrigerators, cupboard space and vacuum containers for hot or cold foods and liquids. Men's and ladies' dressing rooms and toilets. Lower-deck fore and aft cargo compartment doors have sills at truck-level height. Capacity of compartments: control cabin 472 cub. ft. (13.2 m^3), main upper deck passenger compartment 4,041 cub. ft. (113.2 m^3), lower passenger lounge 500 cub. ft. (14.15 m^3), ladies' dressing room 228 cub. ft. (6.38 m^3), men's dressing room 238 cub. ft. (6.66 m^3), galley 350 cub. ft. (9.8 m^3), forward cargo hold 520 cub. ft. (14.56 m^3), rear cargo hold 325 cub. ft. (9.1 m^3). Heights of fuselage doors: main entrance door 9 ft. 10 in. (3 m.), forward cargo hold door 4 ft. 11 in. (1.5 m.), rear cargo hold door 4 ft. 5 in. (1.34 m.). Width of main cabin (inside linings) 10 ft. $4\frac{1}{2}$ in. (3.16 m.). Complete automatic air-conditioning equipment with pressurization permitting operation at 15,000 ft. (4,575 m.) with sea-level cabin atmosphere and at 25,000 ft. (7,625 m.) with equivalent cabin pressure of 5,500 ft. (1,680 m.), combined radiant and convection heating, cabin cooling and ground air-conditioning with self-contained power supply.

DIMENSIONS.—
- Span 141 ft. 3 in. (43 m.).
- Length 110 ft. 4 in. (33.65 m.).
- Height 38 ft. 3 in. (11.66 m.).
- Height (with fin and rudder folded) 26 ft. 7 in. (8.11 m.).

WEIGHTS AND LOADINGS.—
- Weight empty 83,500 lb. (37,910 kg.).
- Designed disposable load 59,000 lb. (26,786 kg.).
- Designed normal take-off weight 145,800 lb. (76,195 kg.).
- Landing weight 121,700 lb. (55,252 kg.).
- Wing loading 80.5 lb./sq. ft. (392.8 kg./m^2).
- Power loading 10.2 lb./h.p. (4.63 kg./h.p.).

PERFORMANCE.—
- Max. speed 375 m.p.h. (603 km.h.) at 25,000 ft. (7,625 m.).
- Max. cruising speed (1,900 h.p. per engine) 340 m.p.h. (544 km.h.) at 25,000 ft. (7,625 m.).
- Landing speed 93 m.p.h. (150 km.h.).
- Rate of climb at sea level 1,100 ft./min. (335 m./min.).
- Rate of climb on three engines 500 ft./min. (152 m./min.).
- Service ceiling over 32,000 ft. (9,760 m.).
- Three-engine ceiling 21,000 ft. (8,540 m.).
- Take-off run to clear 50 ft. (15.25 m.) (at 135,000 lb. = 61,290 kg. take-off weight) 1,800 yds. (1.647 m.).
- Landing run from 50 ft. (15.25 m.) (at 105,000 lb. = 47,520 kg. landing weight) 1,880 yds. (1,720 m.).
- Landing run from 50 ft. (15.25 m.) with reverse thrust on two engines 1,610 yds. (1,473 m.).
- Range (max. fuel) 4,600 miles (7,360 km.).

THE BOEING STRATOFREIGHTER.

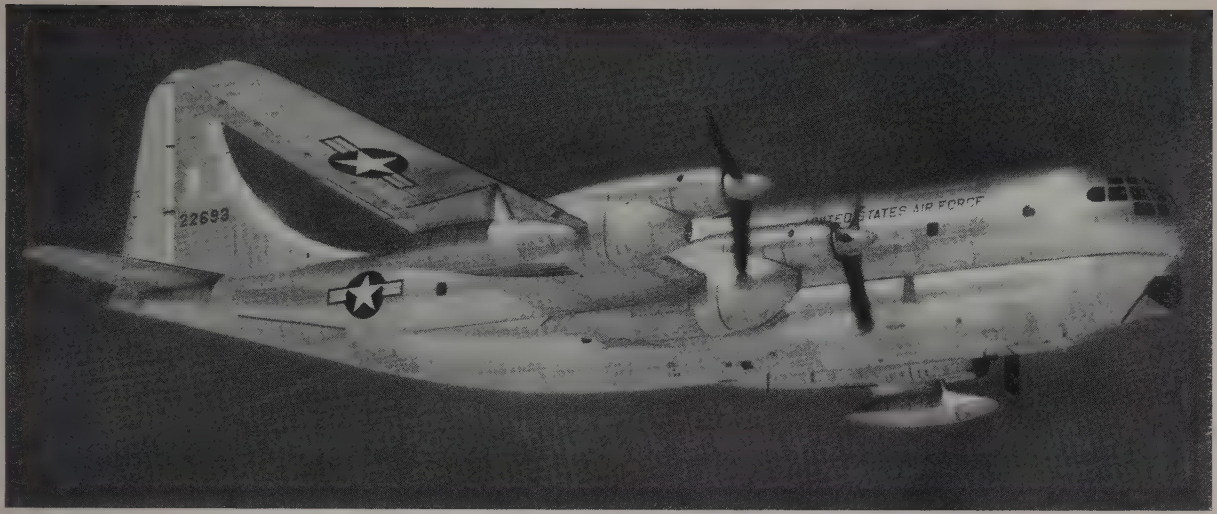
U.S. Air Force designation: C-97.

The C-97 Stratofreighter is the military transport counterpart of the Stratocruiser, from which it differs principally in the arrangement and equipment of the large two-deck fuselage. The XC-97 was, in fact, the forerunner of the civil Stratocruiser and all initial prototype trials of the civil airliner were conducted with the XC-97.

The principal structural modification to the C-97 fuselage involves the provision of large loading doors and an internally operated ramp under the rear fuselage to permit the loading of wheeled and tracked vehicles and other bulky cargo. An electrically-operated cargo hoist runs along the entire length of the fuselage. Three fully-loaded $1\frac{1}{2}$-ton trucks or two light tanks can be driven into the fuselage, the drive-up ramp being raised and lowered by the cargo hoist. Adequate cargo handling and tie-down equipment is provided. The cabins can also be arranged to accommodate 134 fully-equipped troops, or be fitted out as a hospital transport for 83 stretcher cases and four attendants.

Three XC-97's were built and these were followed by ten YC-97's in three different versions of the basic design. These prototype and service test aircraft incorporated the wings, tail-unit, landing-gear and power-plant of the B-29. The C-97A

The Boeing KC-97G Tanker-Transport (four Pratt & Whitney R-4360 engines).



The Boeing YC-97J (four 5,700 s.h.p. Pratt & Whitney T34 turboprop engines).

and subsequent production versions use the main components of the B-50.

The 500th Stratofreighter—a KC-97G—was completed on February 8, 1954.

The principal features of the many versions of the C-97 are given below.

C-97A. Four Pratt & Whitney R-4360-27 engines. First production aircraft delivered to U.S.A.F. on October 15, 1949. C-97A has a normal payload of 41,400 lb. (18,800 kg.) and under special conditions can carry up to 53,000 lb. (24,060 kg.). It can accommodate 134 fully-equipped troops or mixed loads of cargo or troops. As an ambulance it can transport 83 stretcher patients with medical supplies and attendants.

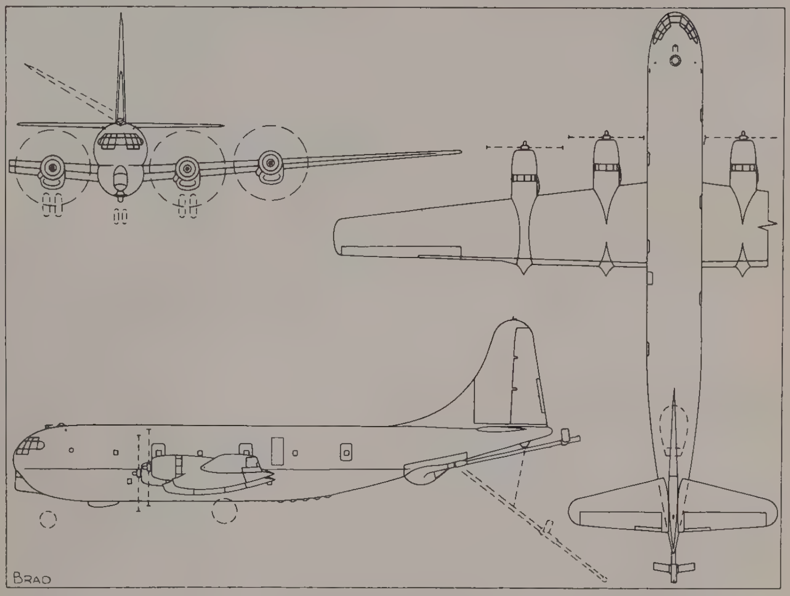
C-97C. Four 3,250 h.p. Pratt & Whitney R-4360-35A engines. Similar to C-97A in general details and performance. New flush-mounted radio antennae, heavier floor, higher payload. First production C-97C delivered to U.S.A.F. in February, 1951.

VC-97D. Three specially-modified C-97A's supplied to U.S.A.F. Strategic Air Command as mobile "command posts." Used as Staff Transports and living quarters for key personnel in overseas training missions.

KC-97E. Four 3,250 h.p. Pratt & Whitney R-4360-35A engines. Multi-purpose transport and tanker. Has permanent fixtures for tanker but can be rapidly converted to cargo or troop carrier, or ambulance. "Pod" carrying "Flying Boom," operator and controls is detachable and tanks, pumps, etc. on upper deck are removable. First production KC-97E delivered to U.S.A.F. in July, 1951.

KC-97F. Four 3,250 h.p. Pratt & Whitney R-4360-59 engines. Convertible tanker-transport. Other details and performance similar to KC-97E.

KC-97G. Four 3,250 h.p. Pratt & Whitney R-4360-59B engines. Development of KC-97F. Change in location of



The Boeing KC-97F Convertible Tanker/Transport.

refuelling tanks and related equipment, so that they need not be removed when aircraft is used as a transport. As a personnel carrier without refuelling equipment can carry 96 fully equipped combat troops, or as an ambulance, 69 stretcher patients, medical attendants and supplies. With refuelling equipment installed can carry 65 fully-equipped troops or 49 stretcher cases, attendants and supplies. Fitted with two external fuel tanks with total capacity for 1,400 U.S. gallons (5,290 litres). Pressurisation system maintains ground atmospheric pressure to 15,500 ft. (4,730 m.).

YC-97J. Two C-97's fitted with four 5,700 h.p. Pratt & Whitney YT34 turboprop engines for development trials with this type of power-plant. Gross weight 175,000 lb. (79,450 kg.). First YC-97J made its maiden flight on April 19, 1955.

The particulars below refer specifically to the KC-97G.

DIMENSIONS.—
- Span 141 ft. 3 in. (43.1 m.).
- Length 110 ft. 4 in. (33.64 m.).
- Height 38 ft. 3 in. (11.6 m.).

WEIGHTS.—
- Weight empty 82,500 lb. (37,450 kg.).
- Weight loaded 153,000 lb. (69,460 kg.).
- Max. permissible loaded weight 175,000 lb. (79,450 kg.).
- Landing weight 121,000 lb. (54,930 kg.).

PERFORMANCE.—
- Max. speed 375 m.p.h. (600 km.h.).
- Cruising speed 300 m.p.h. (480 km.h.).
- Operating range 4,300 miles (6.880 km.).
- Service ceiling over 35,000 ft. (10,675 m.).

CAPITAL

CAPITAL HELICOPTER CORPORATION.

HEAD OFFICE: P.O. Box 1023, SCHENECTADY, N.Y.

President: Horace T. Pentecost.

Vice-President: Joseph M. Marino.

Secretary and Treasurer: Robert L Scott.

The Capital Helicopter Corpn., which was incorporated in January, 1954, is engaged in the development of the Model C-1 Hoppi-Copter, the complete file of working drawings, engineering data and patent rights of which, and of all previous models of the Hoppi-Copter, formerly owned by Mr. Pentecost, are now the property of the company.

The Model C-1 is a simplified redesign of previous Hoppi-Copters some of which have been illustrated and described in previous editions of "All the World's Aircraft."

The Capital Helicopter Corporation, through its wholly-owned subsidiary, Capital District Flying Service, Inc., is renting and occupying office and shop facilities on the Schenectady County Airport.

THE CAPITAL MODEL C-1 HOPPI-COPTER.

TYPE. Single-seat pulsejet-driven Helicopter.

ROTOR.—Two-blade "see-saw" type rotor. All-metal blades. NACA 8H12 aerofoil section. Chord 6 in. (15.24 cm.). Rotary seal fitting at the hub allows fuel to pass from tank behind pilot through hub and hollow blades to tip pulsejets.

FUSELAGE.—Welded steel tube open frame.

TAIL.— Steel - tube - framed fabric - covered rudder on sloping hinge for directional control.

LANDING GEAR.—Three radially spaced legs

with hinged extensions sprung by rubber cord, each carrying at its extremity a full-castoring 6 × 2 : 00 wheel.

POWER PLANT.—Two 4-inch pulsejet units developed by the Naval Research laboratories mounted one at each rotor-blade tip. Each pulsejet develops 23 lb. (10.4 kg.) s.t. Fuel tank (16 U.S. gallons = 60.5 litres capacity) behind pilot.

ACCOMMODATION.—Open pilot's seat.

CONTROLS.—Co-ordinated throttle and collective-pitch control at pilot's left hand. Direct-connected stabilised cyclic-pitch control from hub swash-plate to pilot's right hand. Foot pedal directional rudder control. Centre of gravity trim control to accommodate pilots of widely-varying weights and build.

DIMENSIONS.—
Rotor diameter 18 ft. (5.49 m.).

WEIGHTS (Designed).—
Weight empty 130 lb. (59 kg.).
Fuel (16 U.S. gallons) 100 lb. (45.4 kg.).
Pilot and baggage 220 lb. (100 kg.).
Normal loaded weight 450 lb. (204.4 kg.).

PERFORMANCE (Estimated).—
Max. speed 90 m.p.h. (144 km.h.).
Normal cruising speed 60 m.p.h. (96 km.h.).
Max. rate of climb at S/L. 800 ft./min. (244 m./min.).
Best climbing speed 40 m.p.h. (64 km.h.).
Max. ceiling 10,000 ft. (3,050 m.).
Endurance 1.5 hours.

The Capital Model C-1 Pulsejet-driven Hoppi-copter.

CESSNA

CESSNA AIRCRAFT COMPANY, INC.

HEAD OFFICE AND WORKS: WICHITA, KANSAS.

Established: September 22, 1927.

President and General Manager: Dwane L. Wallace.

Vice-President and Chief Engineer: Tom Salter.

Vice-President, Manufacturing: Del Roskam.

Vice-President and Treasurer: Frank Boettger.

Manager, Helicopter Division: Jack Leonard.

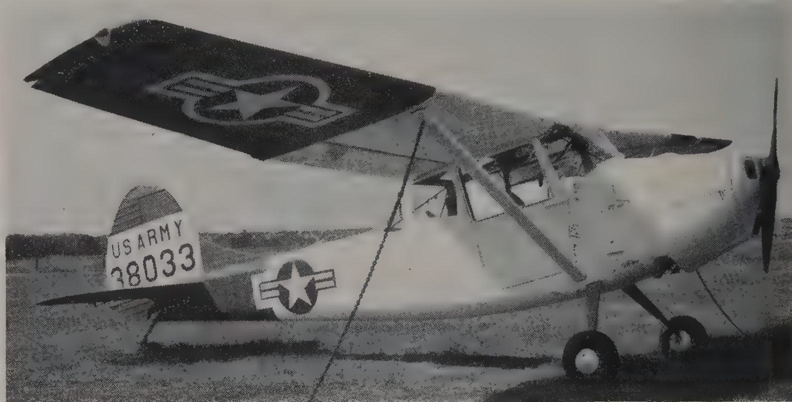
The Cessna Aircraft Company was founded by Mr. Clyde V. Cessna, a pioneer in U.S. aviation since 1911, and was incorporated in 1927. Before the war the company was in production with the Airmaster and the twin-engined T-50.

The Company has now designed five enclosed high-wing monoplanes for civilian use, the 85 h.p. and 90 h.p. Model 140, both two-seat aircraft; the 145 h.p. Model 170 and 225 h.p. Model 180 four-seaters, and the 240 h.p. Model 190 and 245 h.p. Model 195A, the last two being four/five-seat aircraft. Production of the Model 140 and Model 190 has been discontinued, whereas the Model 180 was introduced in 1953. The latest production aircraft is the Model 310, a twin-engined monoplane for executive use.

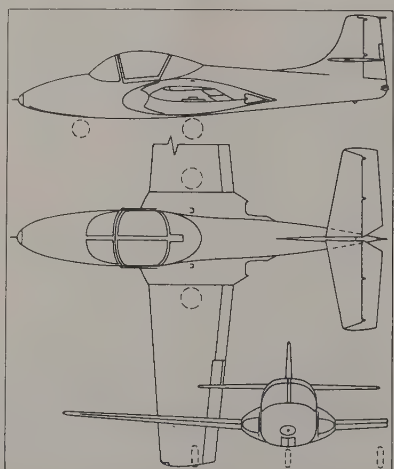
In 1950 the Cessna 305, a military development of the Model 170, won the U.S.A.F. competition for a liaison and observation/reconnaissance aircraft to meet the requirements of the U.S. Army Field Forces. It had been produced in quantity for the U.S. Army, U.S.A.F. and U.S. Marine Corps. Production of the Model 305 ceased in October, 1954.

The latest Cessna military observation/reconnaissance aircraft is the Model 321 (OE-2), which is in production for the U.S. Marine Corps.

The company was successful in 1953 in winning a U.S.A.F. design competition for a twin-jet primary trainer to be powered by two Continental J69 (Turbomeca Marboré) turbojet engines. Details of this aircraft, the Model 318 (T-37), appear below.



The Cessna L-19A (213 h.p. Continental O-470 engine). (*Gordon Williams*).


The Cessna T-37.

THE CESSNA MODEL 318.

U.S.A.F. designation: T-37.

The T-37, Cessna's first jet aircraft, was the winner of a Design Competition for a two-seat side-by side intermediate jet trainer, for which fifteen proposals were submitted to the U.S.A.F. Air Research and Development Command. The first prototype XT-37 made its first flight on October 12, 1954.

TYPE.—Two-seat Intermediate Trainer.

WINGS.—Low-wing cantilever monoplane. All-metal structure. Hydraulically-operated all-metal high-lift slotted flaps inboard of ailerons. Electric trim-tabs in ailerons, which are metal-framed and fabric-covered.

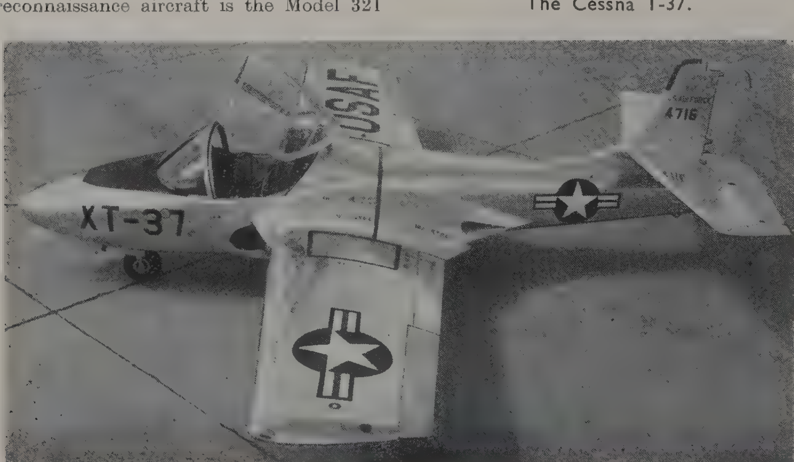
FUSELAGE.—All-metal structure. Hydraulically-actuated speed brake, below forward fuselage in region of cockpit, is normally flush with fuselage contour and extends to a maximum angle of 50°.

TAIL UNIT.—Cantilever monoplane type. Fin integral with fuselage, tailplane mounted one-third of way up fin. Movable surfaces, all of which have electrically-operated trim-tabs, have metal frames and fabric covering.

LANDING GEAR.—Retractable nose-wheel type. Hydraulic actuation. Wheel brakes operated by separate hydraulic system controlled by dual rudder and brake pedals.

POWER PLANT.—Two Continental J69 (Turbomeca Marboré II licence) axial-flow turbojet engines with air inlets and jet exits in thickened wing roots. Six rubber-cell inter-connected fuel tanks in wings feeding main tank in fuselage aft of cockpit. Automatic fuel transfer by engine-driven pumps and submerged booster pumps. Engine inlet screens operate in conjunction with landing-gear and extend or retract automatically when gear is lowered or raised.

ACCOMMODATION.—Enclosed cockpit seating



The Cessna XT-37 Trainer (two Continental J67 turbojet engines).

two side-by-side with dual controls. Ejector seats and jettisonable clam-shell type canopy. Standardised cockpit lay-out, with flaps, speed brakes, trim-tabs, radio controls, etc. positioned and operated as in standard U.S.A.F. combat-type air-craft.

DIMENSIONS.—
Span 33 ft. (10.0 m.).
Length 27 ft. 1 in. (8.26 m.).
Height 8 ft. 9½ in. (2.68 m.).

WEIGHT.—
Designed gross weight 5,600 lb. (2,540 kg.).

PERFORMANCE.—
Max. speed over 350 m.p.h. (560 km.h.).
Range over 345 miles (550 km.).

THE CESSNA MODEL 305A BIRD DOG.
U.S. Army Field Forces designation: L-19A.
U.S. Marine Corps designation: OE-1.

The Model 315 was developed for the U.S. Army Field Forces as a light reconnaissance aircraft, which could also be used for observation, liaison and training. The first contract for 14 aircraft was placed in June 1950.

The last production L-19 was completed on October 7, 1954, bringing the total built for the U.S. services to 2,480 in just over four years. The Bird Dog is still in widespread use and is likely to continue in service for some considerable time to come.

The Bird Dog is a two-seat aircraft. A wide door opening and a large rear cabin and baggage compartment provide ample space for a standard stretcher, for which support brackets are fitted.

The power-plant consists of a 213 h.p. Continental O-470-11 flat-six air-cooled engine. Fuel is carried in two wing tanks with a total capacity of 42 U.S. gallons (160 litres).

Electrically-operated flaps developed by Cessna are being fitted to all L-19A's as they pass through IRAN (Inspection, Repair as necessary) Modification Centers.

Winterisation equipment which will permit L-19A's to operate in temperatures as low as 60° below Zero has been developed and is available in kit form. The equipment includes a 25,000 BThU heater, a 4-inch pre-heater hose, nose shutters, electric oil dilution unit, electric primer, internal window de-frosters and a carburettor heater unit.

DIMENSIONS.—
Span 36 ft. (10.9 m.).
Length 24 ft. 11½ in. (7.6 m.).
Height 7 ft. 6 in. (2.28 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,498 lb. (680 kg.).
Weight loaded (primary mission) 2,200 lb. (1,000 kg.).
Max. weight loaded (alternative missions) 2,430 lb. (1,103 kg.).
Wing loading 12.1 lb./sq. ft. (59 kg./m.^{2}).
Power loading 11.05 lb./h.p. (5 kg./h.p.).

PERFORMANCE.—
Max. speed 130 m.p.h. (208 km.h.).
Cruising speed (29% power) at 5,000 ft. (1,525 m.) 104 m.p.h. (166.4 km.h.).
Stalling speed 54 m.p.h. (86.4 km.h.).
Initial rate of climb 1,485 ft./min. (453 m./min.).
Service ceiling 22,900 ft. (6,985 m.).
Absolute ceiling 24,800 ft. (7,565 m.).
Cruising range 800 miles (1,280 km.).
Take-off over 50 ft. (15.25 m.) obstacle from grass 560 ft. (171 m.).
Landing from 50 ft. (15.25 m.) on grass 600 ft. (183 m.).

The Cessna OE-1 Liaison Monoplane (213 h.p. Continental O-470 engine). (*Gordon Williams*)

The Cessna XL-19B (210 h.p. Boeing XT-50 turboprop engine).


The Cessna XL-19C (280 h.p. Continental XT-51 turboprop engine). (*Gordon Williams*).

THE CESSNA XL-19B and XL-19C.

Two L-19's, designated XL-19B and XL-19C respectively, are being used to investigate the possibilities of small gas-turbine engines for military use. The XL-19B is fitted with a 210 h.p. Boeing XT-50 (Model 502-8) turboprop and the XL-19C with a 280 h.p. Continental XT-51 (Turbomeca Artouste) turboprop engine.

The advantages of the turbine over the conventional engine include a saving in power-plant weight, simplification of engine installation, elimination of cooling problems and almost complete suppression of vibration. The gas turbine can also operate on diesel fuel, any grade of automotive fuel, Army standard truck fuel, high octane gasoline or the standard turbo fuels. The XL-19B made its first flight on November 5, 1952.

On November 11, 1953, the XL-19B established a new World's light aeroplane height record by reaching 37,063 ft. (11,304 m.).


The Cessna OE-2 (260 h.p. Continental O-470 engine).

THE CESSNA MODEL 321.
U.S. Marine Corps designation: OE-2.

The Model 321 is a two-seat reconnaissance monoplane which is in production for the U.S. Marine Corps.

Although similar in appearance to its

predecessor, the OE-1, the OE-2, is a completely new aeroplane which exemplifies a new concept in liaison aircraft performance and equipment.

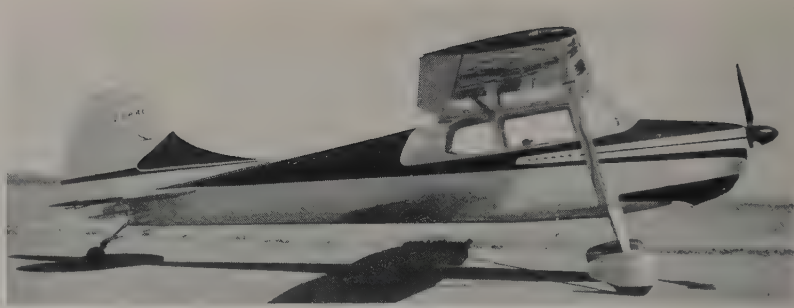
The OE-2 is powered by a 260 h.p. Continental O-470-2 supercharged engine which gives it a top speed of 190 m.p.h. (304 km.h.) at 10,000 ft. (3,050 m.).

Pilot and observer are protected against enemy fire by flak curtains and seat armour. Self-sealing fuel tanks are also fitted.

Equipment includes specialised radio equipment for flexible communication with ground troops.

Other features which extend its versatility include its ability to carry a 250-lb. bomb or three rockets under each wing, a telephone wire-laying container, a chemical spray tank for laying smoke screens, or an aerial delivery containor for dropping supplies.

No other details were available for publication at the time of closing for press.



The Cessna Model 170 (145 h.p. Continental C145 engine).

THE CESSNA 1955 MODEL 170.

Type.—Four-seat Cabin monoplane.

Wings.—High-wing braced monoplane. NACA 2412 wing section. Aspect ratio 7.46. Dihedral 2° 8′. All-metal single-spar structure with metal skin. Single bracing strut on each side. NACA slotted flaps inboard of ailerons. Aileron area (total) 18.3 sq. ft. (1.70 m.²). Total flap area 21.23 sq. ft. (1.97 m.²). Gross wing area 174 sq. ft. (16.2 m.²).

The Cessna Model 180 (225 h.p. Continental O-470 engine).

Fuselage.—All-metal monocoque.

Tail Unit.—Cantilever monoplane type. All-metal structure. Horn-balanced rudder and elevators. Areas: fin 9.0 sq. ft. (0.84 m.²), rudder 9.42 sq. ft. (0.87 m.²), elevators (total) 15.42 sq. ft. (1.43 m.²), tailplane 19.80 sq. ft. (1.84 m.²).

Landing Gear.—Cessna patented gear of chrome-vanadium spring steel. Hydraulic wheel-brakes. Wheel fairings optional. Steerable full swivelling tail-wheel. Track 7 ft. 6½ in. (2.29 m.). Edo Model 2000 floats, skis or cross-wing wheels are optional.

Power Plant.—One 145 h.p. Continental C145-2 six-cylinder horizontally-opposed air-cooled engine. McCauley two-blade metal airscrew. Fuel tanks in wings. Fuel capacity 42 U.S. gallons (159 litres).

Accommodation.—Cabin seats four in two pairs, front pair with dual controls. Baggage space aft of rear seats. 36-inch wide door on each side of cabin giving access to all seats and to simplify loading if rear seats removed and cabin used for freight. Combined heating and ventilation system. Fibreglas soundproofing.

Dimensions.—
Span 36 ft. (10.9 m.).
Length 24 ft. 11½ in. (7.6 m.).
Height 6 ft. 7 in. (2 m.).

Weights and Loadings.—
Weight empty 1,205 lb. (547 kg.).
Weight loaded 2,200 lb. (1,000 kg.).
Wing loading 12.6 lb./sq. ft. (61.48 kg./m.²).
Power loading 15.2 lb./h.p. (6.9 kg./h.p.).

Performance.—
Max. speed 140 m.p.h. (224 km.h.).
Cruising speed 120 m.p.h. (192 km.h.).
Stalling speed 52 m.p.h. (83 km.h.).
Initial rate of climb 690 ft./min. (210 m./min.).
Service ceiling 15,500 ft. (7,730 m.).
Endurance (cruising) over 4½ hours.

THE CESSNA MODEL 180.

The Model 180, although generally similar in layout and construction to the Model 170, is a completely new aircraft which was first announced in January, 1953.

A four-seater, the Model 180 is powered with a 225 h.p. Continental O-470-J engine driving an all-metal constant-speed airscrew.

The most noticeable external difference between the Models 170 and 180 is the latter's new tail-unit of distinctive outline, which can be seen in the accompanying illustration.

Dimensions.—
Span 36 ft. (10.9 m.).
Length 26 ft. 2 in. (7.9 m.).
Height 7 ft. 6 in. (2.28 m.).

Weights and Loadings.—
Weight empty 1,480 lb. (672 kg.).
Weight loaded 2,550 lb. (1,158 kg.).
Wing loading 14.6 lb./sq. ft. (71.25 kg./m.²).
Power loading 11.3 lb./h.p. (5.13 kg./h.p.).

Performance.—
Max. speed over 165 m.p.h. (264 km.h.).
Cruising speed over 150 m.p.h. (240 km.h.).
Initial rate of climb 1,150 ft./min. (350 m./min.).
Service ceiling 19,800 ft (6,040 m.).
Endurance (cruising) over 4½ hours.

THE CESSNA MODEL 620.

The Model 620 represents a design for a four-engined fully-pressurised eight/ten seat miniature airliner intended specifically for business executive use. A prototype is being built but production and marketing plans will await results of an extensive market survey.

The Model 620 will be a conventional all-metal low-wing monoplane with retractable nose-wheel landing-gear and will be powered by four Continental GS0-526 geared and supercharged engines each of which will maintain a maximum continuous power of 290 h.p. up to 15,000 ft. (4,575 m.). All fuel will be carried in outer wing bladder-type cells and in tip tanks. An Air Research turbine-powered air-conditioning and pressurisation unit will be located in the fuselage aft of the passenger compartment.

The prototype was due to fly sometime in 1956.

THE CESSNA MODEL 310.

The Model 310 is a twin-engined five-seat cabin monoplane which marks Cessna's post-war re-entry into the light multi-engined personal or executive aircraft field. The prototype 310 made its first flight on January 3, 1953. It was used, together with a second aircraft, for exhaustive service trials throughout 1953.

The Model 310 was put on the market in January, 1954.

Type.—Twin-engined Five-seat Cabin monoplane.

Wings.—Low-wing cantilever monoplane. All-metal flush-riveted structure. Electrically-operated split flaps between ailerons and fuselage. Maximum flap depression 45°. Wing area 175 sq. ft. (16.2 m.²).

Fuselage.—All-metal flush-riveted structure.

Tail Unit.—Cantilever monoplane type. All-metal flush riveted structure. Trim tabs in rudder and elevators. Radio antenna in plastic leading-edge of fin.

The Cessna Model 180 with Edo Type 289 amphibian floats.

LANDING GEAR.—Retractable nose-wheel type. Electro - mechanical retraction. Cessna type oleo shock-absorber struts. Nose wheel steerable to 15° and castoring from 15° to 55° in both directions.

POWER PLANT.—Two 240 h.p. Continental O-470-B six-cylinder horizontally-opposed air-cooled engines. Each engine exhausts into two stainless steel augmenter tubes terminating above wing ahead of trailing-edge. Two-blade metal constant-speed full-feathering airscrews. All fuel in two permanently-attached wing-tip tanks each of which contains a bladder-type fuel cell holding 50 U.S. gallons (189 litres). Cross-feed fuel system. Each wing tank is also fitted with an electrical fuel boost pump.

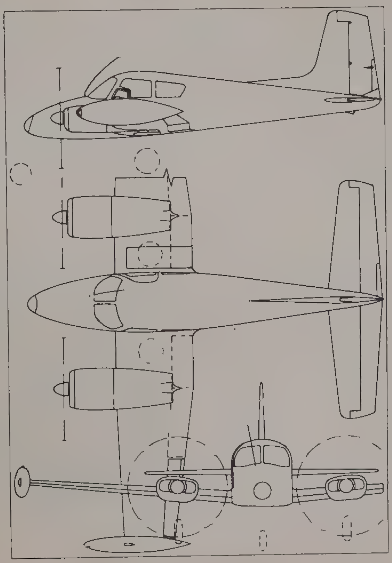
ACCOMMODATION.—Cabin seats five, two in front and three on cross bench behind. Controlled heating provided by Stewart-Warner thermostatically-controlled blower-type heater. Large door on starboard side giving access to all seats. Baggage compartment aft of cabin with internal and external access. Baggage capacity 200 lb. (91 kg.).

DIMENSIONS.—
- Span 36 ft. 1 in. (11.0 m.).
- Length 27 ft. 1 in. (8.26 m.).
- Height 10 ft. 5 in. (3.17 m.).

WEIGHTS AND LOADINGS.—
- Weight empty 2,850 lb. (1,294 kg.).
- Weight loaded (5 people, max. fuel and oil 225 lb. = 102 kg. baggage and optional equipment) 4,600 lb. (2,088 kg.).
- Wing loading 26.2 lb./sq. ft. (127.7 kg./m.^{2}).
- Power loading 9.6 lb./h.p. (4.35 kg./h.p.).

PERFORMANCE (at 4,600 lb. = 2,088 kg. A.U.W.).—
- Max. speed at S/L. over 220 m.p.h. (352 km.h.).
- Cruising speed (70% power) at 8,000 ft. (2,440 m.) over 205 m.p.h. (328 km.h.).
- Cruising speed (60% power) at 10,000 ft. (3,050 m.) 190 m.p.h. (304 km.h.).
- Cruising speed (50% power) at 10,000 ft. (3,050 m.) 175 m.p.h. (280 km.h.).
- Rate of climb at S/L. 1,700 ft./min. (518 m./min.).
- Rate of climb on one engine at S/L. 380 ft./min. (116 m./min.).
- Service ceiling 20,000 ft. (6,100 m.).
- Service ceiling on one engine 7,500 ft. (2,290 m.).
- Cruising range (60% power) at 10,000 ft. (3,050 m.) 875 miles (1,400 km.).
- Cruising range (50% power) at 10,000 ft. (3,050 m.) 1,000 miles (1,600 km.).

The Cessna Model 310 (two 240 h.p. Continental O-470 engines).



The Cessna Model 310

THE CESSNA CH-1 HELICOPTER.

Cessna's entry into the helicopter field resulted from its acquisition of the Seibel Helicopter Company on March 1, 1952. The Cessna Helicopter Division has been established at the company's Prospect plant, 5 miles south-west of Wichita and Charles Seibel retained as chief engineer of the Division.

Work on Cessna's first helicopter began in the Summer of 1952. Following wind-tunnel tests, a flying test-bed to prove the control and transmission system was built and this test vehicle first flew in July, 1953. The present CH-1 was flown for the first time in July, 1954.

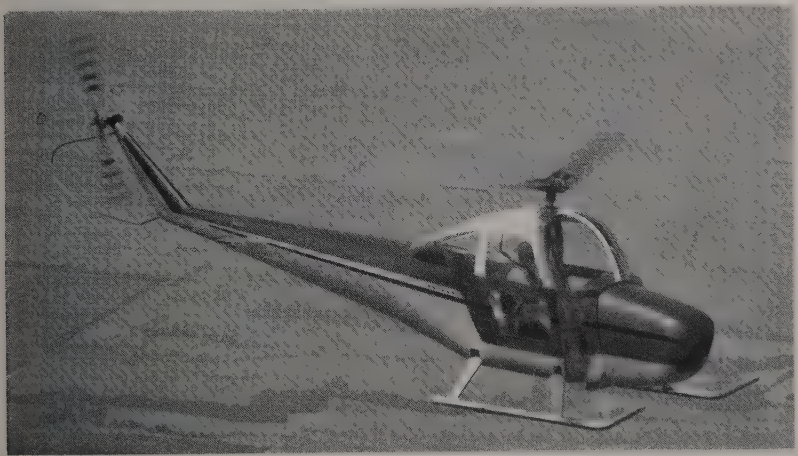
The two most notable features of the CH-1 are the method of blade attachment to the main rotor hubs, by means of flexible steel sheet L-section hinges which permit continuously-varying pitch of the blades without the need for pitch-change bearings; and the positioning of the engine in the nose of the fuselage, leaving greater passenger and/or cargo space near the C.G., and providing for better cooling and easier engine accessibility. The transmission system is also a simplified one, there being only three gears in the main transmission and two in the tail rotor assembly.

The CH-1, which employs a two-blade main rotor and a conventional two-blade anti-torque rotor, is of all-metal construction and is powered by a Continental FSO-470-A supercharged fan-cooled engine which delivers 260 net h.p. to the transmission. The cabin normally seats two side-by-side.

DIMENSIONS.—
- Diameter of main (2-blade) rotor 35 ft. (9.30 m.).
- Diameter of tail rotor 7 ft. (2.13 m.).
- Fuselage length 32 ft. 1 in. (18.78 m.).
- Fuselage width 5 ft. 4 in. (1.62 m.).
- Height to top of cabin 7 ft. 1¾ in. (2.18 m.).
- Overall length (main rotor fore and aft) 42 ft. 8 in. (13.0 m.).
- Overall height 8 ft. 3⅝ in. (2.53 m.).

WEIGHTS AND LOADINGS.—
- Weight empty 1,975 lb. (897 kg.).
- Disposable load 1,025 lb. (465 kg.).
- Weight loaded 3,000 lb. (1,362 kg.).
- Disc loading 3.12 lb./sq. ft. (15.22 kg./m.^{2}).
- Power loading 10.2 lb./h.p. (4.63 kg./h.p.).

PERFORMANCE (at 3,000 lb. = 1,362 kg. A.U.W.).—
- Max. speed at S/L. 122 m.p.h. (195 km.h.).
- Cruising speed 100-120 m.p.h. (160-192 km.h.).
- Rate of climb at S/L. 1,150 ft./min. (350 m./min.).
- Climb to 10,000 ft. (3,050 m.) 9 min. 27 sec.
- Hovering ceiling 11,000 ft. (3,355 m.).
- Cruising range 270 miles (432 km.).
- Endurance 3.7 hours.



The Cessna CH-1 Helicopter (260 h.p. Continental FSO-470 engine).

CHAMPION

CHAMPION AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: HOLMAN FIELD, ST. PAUL, MINNESOTA.

President: Robert Brown.

Vice-President in charge of Production: Henry Dickhudt.

Executive Vice-President: George B. Millard.

The Champion Aircraft Corpn. has been formed by Flyers Service, Inc. to build and market the Model 7 Champion light two-seat training and agricultural monoplane, the manufacturing rights of which were bought from the Aeronca Manufacturing Corporation by Flyers Service, Inc. in June, 1954. Flyers Service, Inc. has specialised for many years in aircraft service, repair and maintenance.

Over ten thousand Model 7 Champions were produced by Aeronca between 1946 and 1951. The same basic design was also used for the L-16A and L-16B light liaison, reconnaissance and training aircraft, over 600 of which were supplied to the Army Ground Forces.

Complete parts inventory and all tooling and engineering data of the Model 7 Champion have been acquired by the Champion Aircraft Corpn., which will continue the development and refinement of the aircraft. The new company will also

handle the sale of spares and parts for existing Aeronca-built Champions.

Production of the Champion was begun in late 1954 and the first aircraft came off the assembly line in February, 1955. Production was expected to reach a rate of one aircraft a day by the end of 1955.

THE CHAMPION MODEL 7EC.

TYPE.—Two-seat light cabin monoplane.

WINGS.—High-wing braced monoplane. NACA 4412 wing section. Aspect ratio 7.25. Chord 5 ft. (1.52 m.). Dihedral 2°. Incidence 1°. Two wood spars, aluminium ribs, fabric covering. Steel tube Vee bracing struts. Single-spar fabric-covered ailerons. Total aileron area 16.54 sq. ft. (1.53 m.^{2}). Gross wing area 170.22 sq. ft. (15.81 m.^{2}).

FUSELAGE. — Welded chrome - molybdenum steel tube structure covered with fabric.

TAIL UNIT.—Wire-braced monoplane type. Tubular welded steel frames, fabric covering. Areas: fin 6.0 sq. ft. (0.55 m.^{2}), rudder 6.8 sq. ft. (0.63 m.^{2}), tailplane 14.08 sq. ft. (1.31 m.^{2}), elevators 11.92 sq. ft. (1.11 m.^{2}). Tailplane span 10 ft. $2\frac{1}{4}$ in. (3.12 m.).

LANDING GEAR.—Fixed divided-axle type. Oleo shock-absorber struts. Cleveland Model C-38500 wheels and Model C-7000 brakes. Steerable tail-wheel. Track 5 ft. 10 in. (1.78 m.).

POWER PLANT.—One 90 h.p. Continental C90-12F flat-four air-cooled engine. Sensenich wood or McCauley (Met-L-Prop) metal airscrew. Fuel in one fuselage tank (13 U.S. gallons=49 litres) and one right wing tank (5.5 U.S. gallons=21 litres). Additional tank in left wing optional. Total fuel capacity 18.5 U.S. gallons (70 litres) normal, or 24 U.S. gallons (91 litres) maximum.

ACCOMMODATION.—Enclosed cabin seating two in tandem with dual controls. Interior baggage compartment.

DIMENSIONS.—
Span 35 ft. 2 in. (10.72 m.).
Length 21 ft. 6 in. (6.56 m.).
Height (tail down) 7 ft. (2.13 m.).

WEIGHTS.—
Weight empty 820 lb. (372 kg.).
Max. permissible loaded weight 1,450 lb. (658 kg.).

PERFORMANCE.—
Max speed 135 m.p.h. (216 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Stalling speed (power on) 40 m.p.h. (64 km.h.).
Stalling speed (power off) 44 m.p.h. (70.4 km.h.).
Rate of climb at S/L. 700 ft./min. (213.5 m./min.).


The Champion Model 7EC (90 h.p. Continental C90 engine).

CHANCE VOUGHT

CHANCE VOUGHT AIRCRAFT, INC.

HEAD OFFICE AND WORKS: DALLAS, TEXAS.

President: F. O. Detweiler.
Vice-President: H. B. Sallada.
Controller: N. V. Turney.
Assistant to the President: Keith Baker.
Chief Engineer: R. C. Blaylock.
Sales Manager: W. P. Thayer.
Factory Manager: C. E. Burt.
Treasurer: B. W. Whitten.
Secretary: J. J. Gaffney.

Chance Vought's current production aircraft is the F7U-3 Cutlass, a swept-wing, tail-less fighter developed for the U.S. Navy for shipboard operations The first deliveries of production F7U-3's were made to the U.S. Navy in February, 1954.

The classified nature of Chance Vought's guided missile programme permits only a brief reference to the Regulus, a naval surface-to-surface missile intended for launching from submarines, surface vessels and shore bases. Development of the Regulus, under the sponsorship of the U.S. Navy Bureau of Aeronautics, began in 1947. The missile resembles a small swept-wing jet fighter aircraft and is about 30 ft. (9.15 m.) long. It is equipped with specially-developed remote control devices and a temporary landing-gear, making it possible to use one missile many times during test development and training trials. A single missile has been flown and recovered as many as fifteen times.

The tactical Regulus missile has no landing-gear but carries a war-head. Production of the missile was accelerated during 1953 and 1954. Maximum effort is being devoted to increasing the performance and versatility of advanced missile types,

In May, 1953, the Navy Bureau of Aeronautics announced that Chance Vought had won a design competition for a new fighter designed to operate from aircraft carriers at supersonic speeds, designated F8U. The prototype XF8U-1 exceeded Mach. 1 on its first flight in 1955.

THE CHANCE VOUGHT CRUSADER.
U.S. Naval designation: F8U.

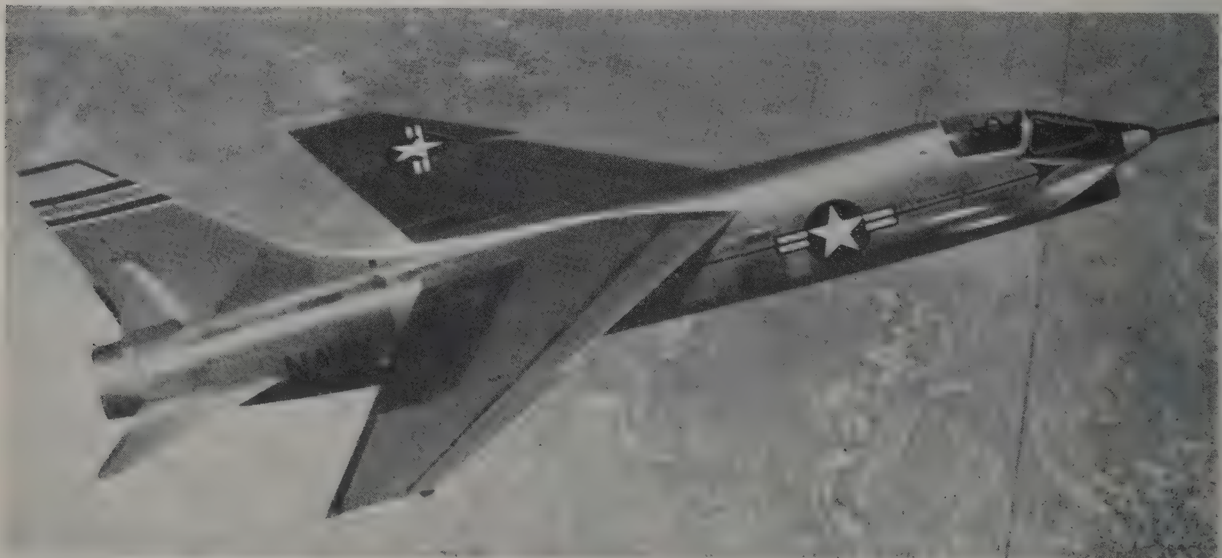
The Crusader is a single-seat supersonic carrier fighter, the general plan of which marks a substantial departure from that of previous Chance Vought naval fighters. The XF8U-1 exceeded Mach 1. on its first flight.

The Crusader is a conventional swept-wing monoplane with the thin-section wings mounted well back from the cockpit and high on the fuselage to provide clearance for the two-position variable-incidence surfaces. The "all-flying" tail is low mounted.

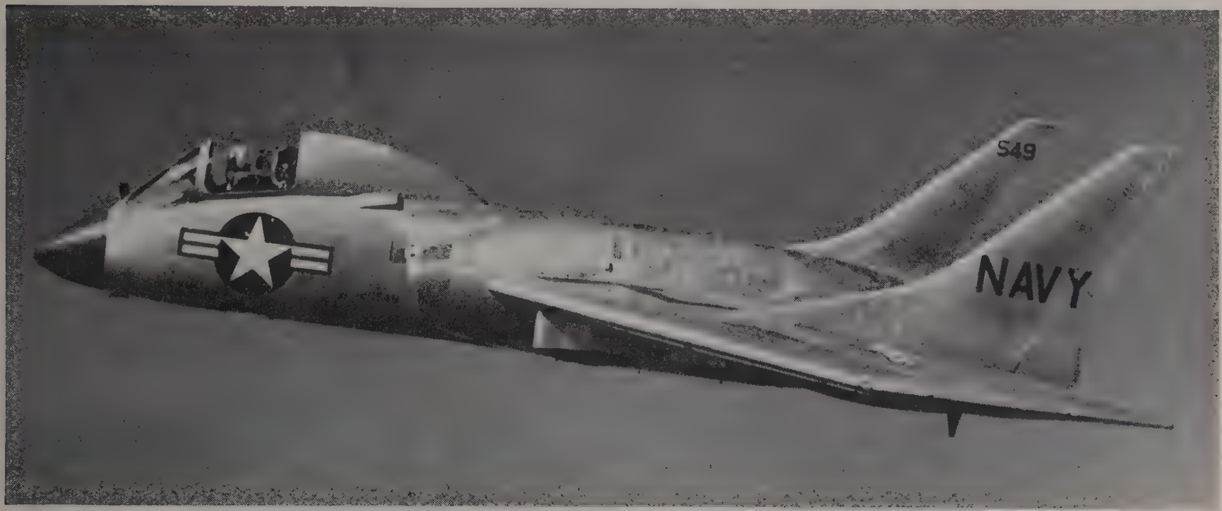
The power-plant is a Pratt & Whitney J57-P-4 turbojet with afterburner.

Titanium is used in the aircraft's after section and in a portion of the mid section. Further weight is saved by the use of a simplified pilot ejection seat which weighs only 30 lb. (13.6 kg.).

No further details of the XF8U-1 were available for publication at the time of closing for press but the general layout of the aircraft can be gathered from the accompanying illustrations.


The Chance Vought XF8U-1 Crusader Naval Carrier Fighter (Pratt & Whitney J57 turbojet engine).

Another view of the Chance Vought XF8U-I Crusader (Pratt & Whitney J57 turbojet engine).

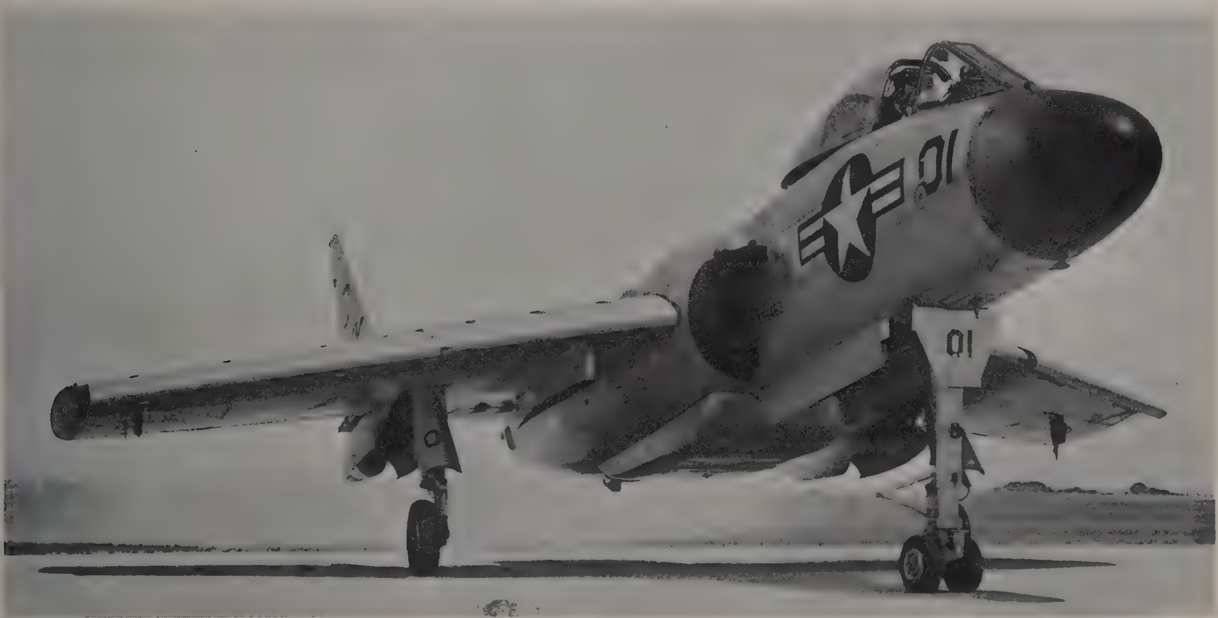


The Chance Vought F7U-3 Cutlass Naval Fighter (two Westinghouse J46 turbojet engines).

THE CHANCE VOUGHT CUTLASS.
U.S. Navy designation: F7U.

The Cutlass is a swept-wing tail-less single-seat twin-jet aircraft which is in production for the U.S. Navy as an interceptor fighter. The wing, which is of symmetrical section and has a sweepback of 35° at quarter chord, is fitted with full-span leading-edge slats, air brakes, power-operated irreversible "ailavators," or combined ailerons and elevators, and vertical fin and rudder surfaces. The "ailavators" are operated by two completely independent hydraulic power control systems connected in tandem. There is no direct mechanical linkage between control stick in the cockpit and the "ailavator" surfaces.

The Cutlass was the first production naval aircraft to achieve supersonic flight, the first to release bombs at a speed greater than that of sound and the first to be catapulted from a carrier while carrying nearly 5,000 lb. of external



The Chance Vought F7U-3 Cutlass Naval Fighter (two Westinghouse J46 turbojet engines). (*Gordon Williams*).

The Chance Vought F7U-3P Cutlass Photographic Reconnaissance monoplane.

stores and weapons. The Cutlass was the first fighter to have incorporated in its design the use of afterburners, full power controls with an "artificial feel" system and an automatic stabilisation system.

The three following versions of the Cutlass have been announced :—

F7U-1. Two Westinghouse J34-WE-32 turbojets with afterburners. First prototype XF7U-1 flew on September 29. 1948. First production F7U-1 flew on March 1, 1950. Fourteen built. Used for training and operational evaluation for aircraft-carrier use.

F7U-3. Two Westinghouse J46-WE-8 turbojet engines (6,000 lb.=2,725 kg. s.t. each) with afterburners. It is larger, has more power, carries a heavier armament load and has better maintenance characteristics than the F7U-1. Fitted with folding wings and arrester-gear for carrier operations. Standard armament consists of four 20 mm. cannon and a new type of rocket launcher carrying "Mighty Mouse" missiles. Normally one pack is mounted under the fuselage but two further packs can be carried under the wings for "strike" missions.

The first production F7U-3 flew for the first time on December 20, 1951, and the aircraft went into production in 1953. First deliveries to the U.S. Navy were made in February, 1954.

F7U-3P. Photographic reconnaissance version of F7U-3. Elongated nose to house camera equipment. This version is illustrated above.

Dimensions (F7U3).—
- Span 39 ft. 8½ in. (12.10 m.).
- Length 44 ft. 3½ in. (13.50 m.).
- Height 14 ft 7.4 in. (4.45 m.).

Weights.—
- Weight empty 18.210 lb. (8,267 kg.).
- Normal loaded weight 27,340 lb. (12,412 kg.).
- Max. loaded weight 31,642 lb. (14,365 kg.).

Performance—.
- Max. speed more than 650 m.p.h. (1,040 km.h.).
- Rate of climb (with afterburner) approx. 13,000 ft./min. (3,965 m./min.).
- Service ceiling approx. 40,000 ft. (12,200 m.).

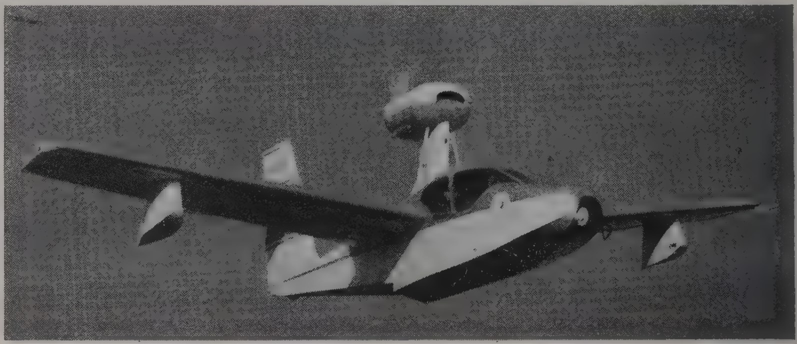
COLONIAL

COLONIAL AIRCRAFT CORPORATION.

Head Office and Works: Deer Park, Long Island, New York.

President: David B. Thurston.

The Colonial Aircraft Corpn. was formed in 1946 by Mr. D. B. Thurston and a group of four other designers and builders to build the Skimmer single-engined pusher amphibian flying-boat. The prototype Skimmer was first flown on July 17, 1948. A flying programme was being conducted in 1955 with a view to obtaining final C.A.A. certification before the end of the year.



The Colonial Skimmer (150 h.p. Lycoming O-320 engine).

THE COLONIAL MODEL C-1 SKIMMER.

Type.—Single-engined 2/3-seat Amphibian.

Wings.—Cantilever shoulder-wing monoplane with tapered wing sections attached directly to sides of hull. Structure consists of duralumin leading and trailing-edge torque boxes separated by a single duralumin main spar or beam. All-metal ailerons. Hydraulically-operated slotted flaps over 80 per cent. of span. Gross wing area 150.6 sq. ft. (14 m.²).

Hull.—Single-step all-metal structure.

Tail Unit.—Cantilever monoplane type. All-metal construction. Controllable elevator trim-tabs. Span of tail 10 ft. (3.05 m.), vertical tail area 22.7 sq. ft. (2.1 m.²), horizontal tail area 26.39 sq. ft. (2.45 m.²).

Landing Gear.—Retractable tricycle type. Knee-action oleo struts on main gear, which retracts into wings. Long-stroke nose-wheel oleo. Nose wheel protrudes when retracted to serve as bumper. Hydraulic retraction using a pressurised accumulator-reservoir as a source of energy. Goodyear wheels, tyres and single-disc hydraulic brakes. Nose wheel is free to swivel 30° either way.

Power Plant.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine mounted on pylon above hull and driving a Sensenich controllable-pitch propeller 6 ft. 2 in. (1.8 m.) diameter. Normal fuel capacity 30 U.S. gallons (113 litres).

Accommodation.—Enclosed cabin normally seating two side-by-side, but third person may be seated behind. Throw-over wheel control standard but dual controls available. Blind-flying instruments, two-way VHF radio and landing lights standard equipment. Baggage capacity of over 40 cub. ft. (1.13 m.³) available in passenger compartment.

Dimensions.—
- Span 34 ft. (10.37 m.).
- Length 23 ft. 6 in. (7.16 m.).
- Height overall 8 ft. 10 in. (2.68 m.).

Weights and Loadings.—
- Weight empty 1,400 lb. (635 kg.).
- Disposable load 700 lb. (318 kg.).
- Weight loaded 2,100 lb. (953 kg.).
- Wing loading 14.0 lb./sq. ft. (68.32 kg./m.²).
- Power loading 14.0 lb./h.p. (6.35 kg./h.p.).

Performance.—
- Max. speed at 5,000 ft. (1,525 m.) 127 m.p.h. (203 km.h.).
- Cruising speed (62% power) 115 m.p.h. (184 km.h.).
- Stalling speed 50 m.p.h. (80 km.h.).
- Initial rate of climb 700 ft./min. (213 m./min.).
- Cruising range 700 miles (1,120 km.).

CONVAIR

CONVAIR DIVISION OF GENERAL DYNAMICS CORPORATION.

Head Office: San Diego 12, Cal.

Manufacturing Divisions: San Diego and Pomona, Cal. and Fort Worth, Tex.

Chairman of the Board: John Jay Hopkins.

President: Joseph T. McNarney.

Executive Assistant to President: E. P. Wohl.

Executive Vice-President: J. V. Naish.

Vice-President and Assistant to President: T. G. Lanphier.

Vice-President: R. H. Biron, Jr.

Vice-President—Engineering: R. C. Sebold.

Vice-President and General Counsel: R. B. Watts.

Vice-President and Manager, Fort Worth Division: A. C. Esenwein.

Manager, San Diego Division: Bernard F. Coggan.

Manager, Pomona Division: Charles F. Horne.

Manager, Daingerfield Division: J. E. Arnold.

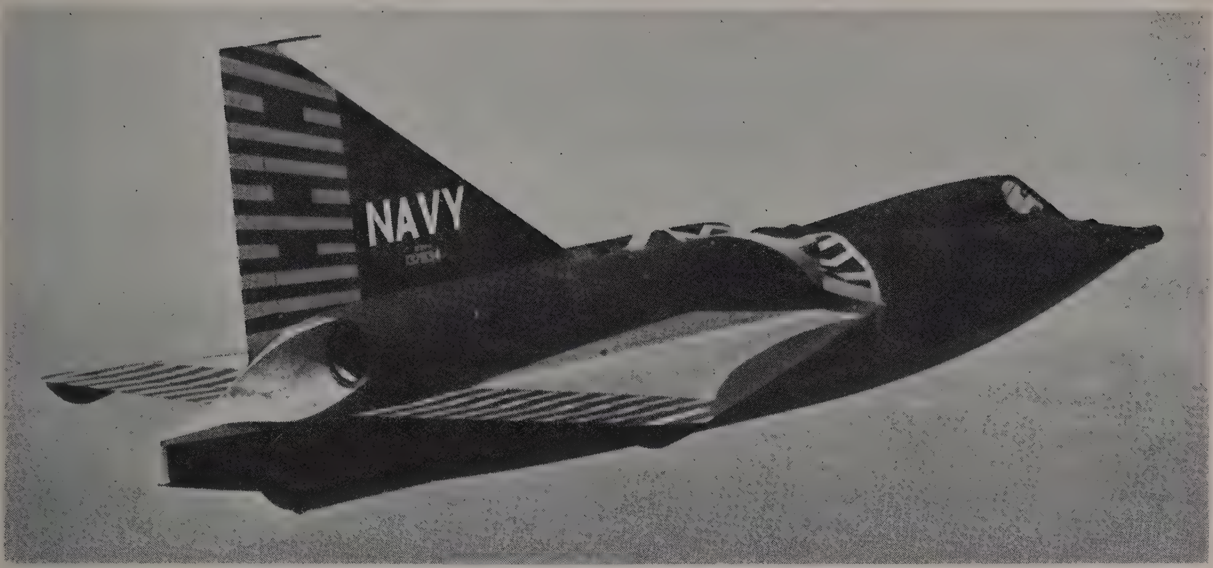
Controller: D. T. Fisher.

Secretary: Edmund Burke.

Treasurer: G. T. Bovee.

Consolidated Vultee Aircraft Corporation resulted from the merger on March 17, 1943, of the properties of the Consolidated Aircraft Corporation and Vultee Aircraft, Inc. The original Consolidated Aircraft Corporation had been incorporated on May 29, 1923.

After having outgrown its original Rhode Island facilities, Consolidated moved in 1924 to Buffalo, N.Y., where it leased a portion of the old wartime Curtiss plant. In the Autumn of 1935 Consolidated moved from Buffalo to San Diego, Cal. to take advantage of an



The Convair XF2Y-I Sea Dart (two Westinghouse J34 turbojet engines).

ice-free harbour and all-the-year-round good flying weather.

Before the merger with Vultee in 1943, Consolidated acquired the Thomas-Morse Aircraft Corporation of Ithaca, N.Y. In 1940 Consolidated had purchased the Hall Aluminium Aircraft Corporation.

On March 1, 1954, the directors of Consolidated Vultee and the General Dynamics Corporation, which had become the largest shareholder in Convair during 1953, voted to merge the two corporations and on April 29, 1954, Consolidated Vultee became the Convair Division of General Dynamics Corporation.

The present activities of the manufacturing divisions may be summarised as follows :—San Diego Division : production of the Convair-Liner 340 and military counterparts of the Convair-Liner 240 and 340—the T-29 navigator-bombardier trainer, the C-131 air evacuation transport, the C-131B electronic test-bed, the C-131D military transport, and the R4Y-1 naval transport ; the R3Y-1 and R3Y-2 cargo transport flying-boats ; the F-102 delta-wing supersonic interceptor fighter ; development of the F2Y-1 Sea Dart experimental delta-wing fighter-type seaplane and the XFY-1 vertical take-off fighter ; and research and development in pilotless aircraft, guided missiles and other restricted projects ; Pomona Division : — research, development and production of guided missiles for the U.S. Navy Bureau of Ordnance ; Forth Worth Division :—production of the B-58 and research and development work on restricted projects.

The Daingerfield Division at Daingerfield, Texas, operates for the U.S. Navy Bureau of Ordnance a highly-important but little publicised Ordnance Aerophysics Laboratory which includes a supersonic wind-tunnel and a ramjet burner test centre for the development of guided missiles.

THE CONVAIR F2Y-1 SEA-DART.

The Sea-Dart is an experimental twin-jet delta-wing fighter type seaplane which has been developed and built for the U.S. Navy Bureau of Aeronautics. It is the first combat-type aircraft to be equipped with retractable hydro-skis. The first prototype XF2Y-1 Sea-Dart, which is powered with two Westinghouse J34 turbojet engines. made its first flight on April 9, 1953.

The second prototype, the YF2Y-2, powered by two Westinghouse J46 engines, exceeded Mach 1 in a shallow dive on August 3, 1954, and thus became the first water-based aircraft in the World to fly faster than sound. It was later destroyed in an accident.

Two new Sea-Darts have joined the first XF2Y-1 to continue the test programme.

DIMENSIONS.—
Span 30 ft. 6 in. (9.3 m.).
Length 41 ft. 2 in. (12.5 m.).
Height (on hydro-skis) 21 ft. 1 in. (6.4 m.).

THE CONVAIR XFY-1.

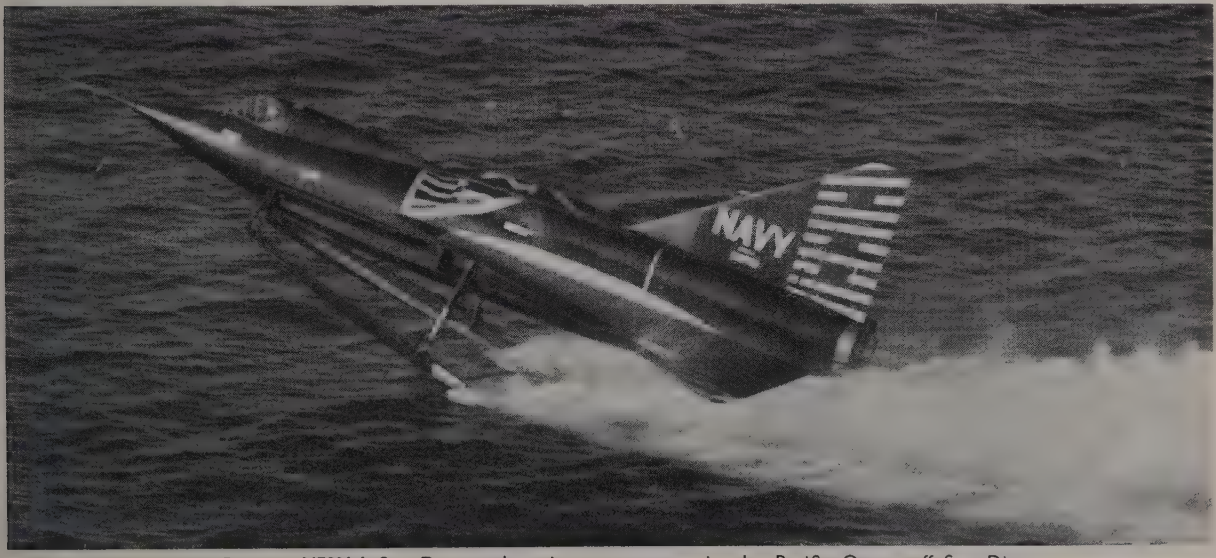
The XFY-1 is an experimental delta-wing fighter which has been designed to take-off and land vertically, while possessing all the qualities of a high-speed fighter in horizontal flight. Its basic function is that of a convoy escort fighter able to take-off, fight and land without the need for a carrier deck.

The short stubby fuselage has a delta wing in the mid position with the fin and rudder and a matching underside fin at right angles to the wing. At the apices of these four surfaces are fitted four oversize castor wheels to serve as a landing-gear, the normal static attitude of the aircraft being vertical.

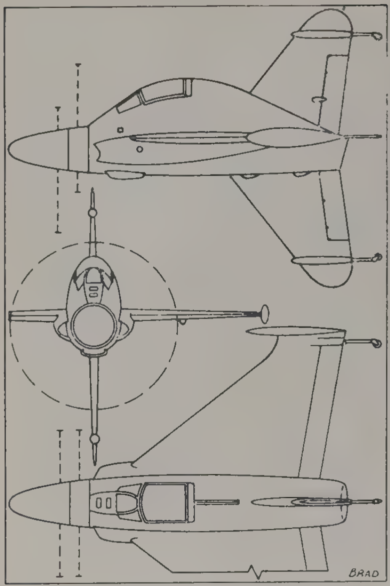
The power-plant consists of a 5,850 h.p. Allison YT40-A-14 turboprop engine driving a 16-foot (4.88 m.) six-blade Curtiss-Wright Turboelectric co-axial contra-rotating airscrew.

The pilot's seat is mounted in gimbals so that it will normally assume suitable positions for take-off, landing and horizontal flight.

A special mobile trolley for transporting the aircraft and for lowering and raising it for maintenance, etc. has been designed



The Convair YF2Y-I Sea Dart undergoing water tests in the Pacific Ocean off San Diego.



The Convair XFY-1.

by Convair, as has a mobile 20-foot (6.10 m.) access ladder for the pilot to reach his cockpit.

Extensive tethered tests were made in a special rig installed in a 195-foot high naval airship hangar at Moffett Field. This rig permitted powered "vertical taxi" tests to be made without the aircraft being out of control from the ground.

In all, some 280 flights were made in this test rig before the aircraft was taken into the open for free flight testing.

The XFY-1 made its first free vertical take-off and landing on August 2, 1954. This was followed by another 70 free vertical up-and-down flights before it made its first transition from vertical to horizontal flight and back to the vertical for landing on November 2, 1954.

The general arrangement of the XFY-1 can be seen from the accompanying photograph and three-view drawing. No other details are available.

The Convair XFY-1 in vertical flight.

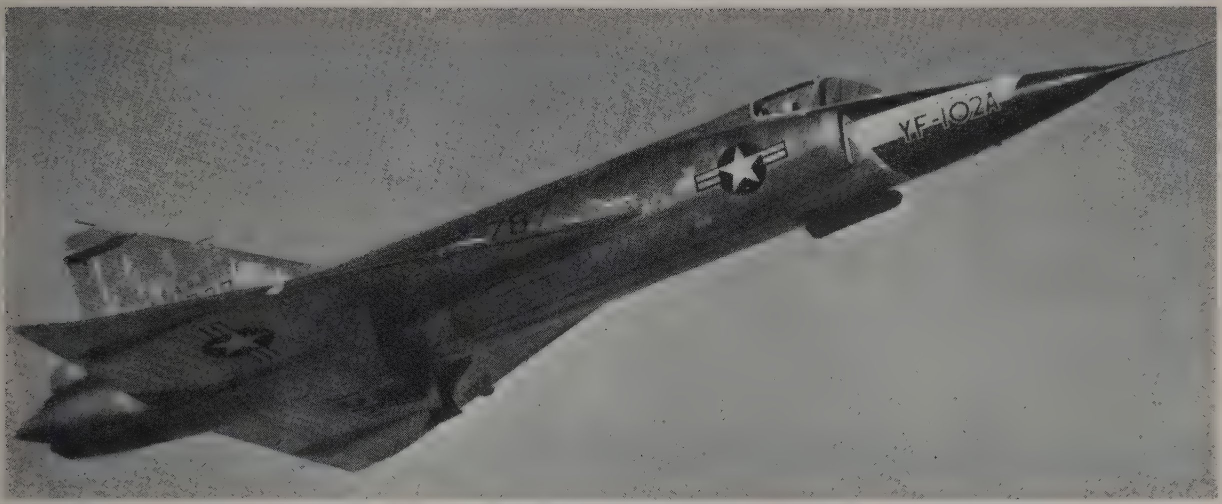
THE CONVAIR F-102.

The F-102 is a supersonic all-weather delta-wing fighter which is in production at San Diego. It will be fitted with an automatic electronic control system which will only need to be monitored by the pilot. The craft is also expected to carry the Hughes GAR-1 Falcon guided missile which will also be automatically fired. The automatic pilotage and firing systems have been developed by the Hughes Aircraft Company.

Two prototype YF-102's were built, both powered by the Pratt & Whitney J57-P-11 engine with afterburner. The first made its maiden flight on October 24, 1953, and the second made its first flight on January 11, 1954.

A developed model, the YF-102A, flew for the first time on December 20, 1954,

The Convair YF-102A Delta-wing All-weather Fighter (Pratt & Whitney J57 turbojet engine).



The Convair YF-102A Delta-wing All-weather Fighter (Pratt & Whitney J57 turbojet engine).

and on the following day it exceeded the speed of sound in level flight.

The YF-102A and the production F-102A have a longer fuselage than the YF-102. The delta wing is unchanged except that it has cambered leading-edges and swept-up wing-tips. The canopy has been re-designed to give the pilot greater visibility.

A two-seat combat proficiency trainer version of the F-102A, designated TF-102A, has also been ordered into production.

The Wright J67 two-spool turbojet engine is scheduled for the F-102B.

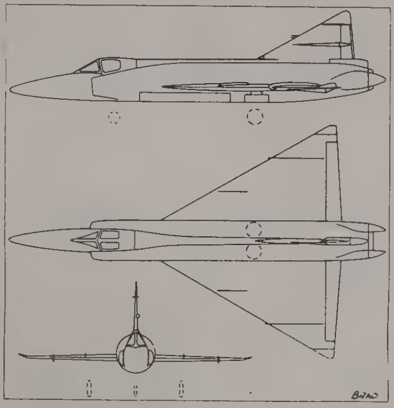
DIMENSIONS.—
Span 38 ft. 2 in. (11.64 m.).
Length 68 ft 3 in. (20.81 m.).
Height 18 ft. 2 in. (5.53 m.).

THE CONVAIR TRADEWIND.

U.S. Navy designation: R3Y.

The R3Y is a long-range transport flying-boat which incorporates the latest developments in flying-boat hulls as evolved by Convair's Hydrodynamic Research Laboratory at San Diego. The R3Y's hull has a length-to-beam ratio of 10 to 1, double that of previous Convair flying-boats.

The R3Y is being built for the U.S. Navy in two versions. These are distinguished as follows :—



The Convair F-102A.

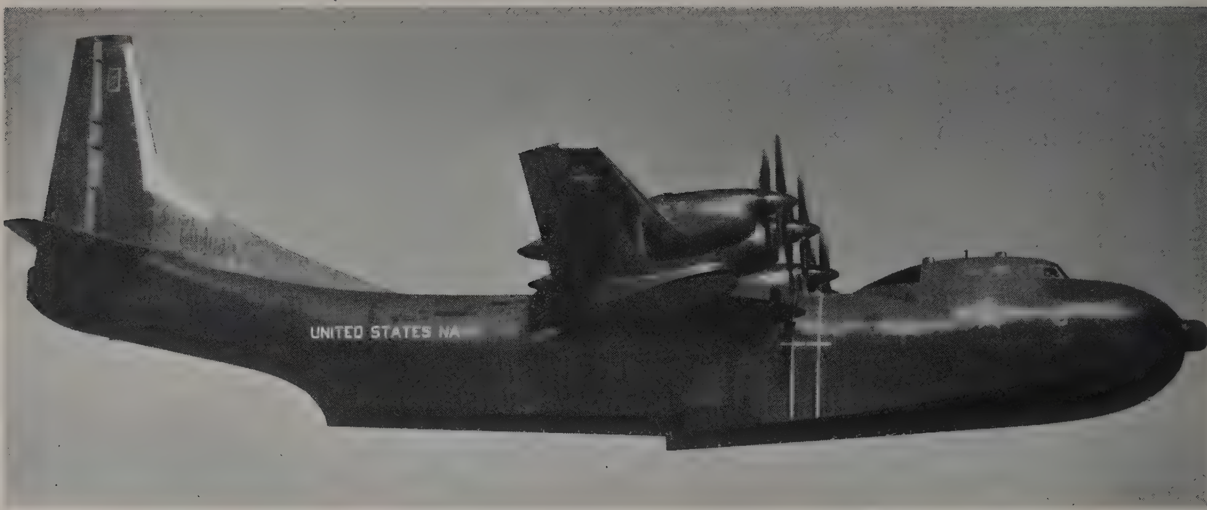
R3Y-1. Four 5,500 h.p. Allison T40-A-10 turboprop engines. First production version. Can carry personnel or cargo, or may be fitted as an ambulance for the transport of both stretcher or sitting cases. All personnel seats of backward-facing type. Large 10 ft. (3.0 m.) wide cargo-loading door on port side aft of wings, with smaller personnel-loading doors on both sides of hull. Entire accommodation pressurised and air-conditioned.

First production R3Y-1 flew for the first time on February 25, 1954. This aircraft was delivered to Patuxent Naval Air Station, Maryland, for evaluation trials on February 24, 1955. It flew non-stop across the United States from San Diego, Cal. to Patuxent, Md. in 6 hours, averaging 403 m.p.h. (645 km.h.).

R3Y-2. Similar to R3Y-1 except that nose section of hull is hinged to swing upwards to permit direct loading of vehicles, heavy freight, etc. Flight deck raised to give clear passage beneath. Main cargo deck 88 ft. (26.8 m.) long and over 9 ft. (2.7 m.) wide. Bow-loading door 6 ft. 8 in. (2.0 m.) high and 8 ft. 4 in. (2.5 m.) wide. Built-in ramp folds down when bow door is open for direct loading from beach or quay. The aircraft can accommodate four 155 mm. howitzers, or three $2\frac{1}{2}$-ton trucks, or six Jeeps, or two half track vehicles or several other types of military equipment. Large cargo-loading door aft of wings. Can also be fitted with 103 demountable rearward-facing seats or can carry 92 stretcher cases plus twelve medical attendants.

First R3Y-2 flew for the first time on October 22, 1954.

The Convair R3Y-1 Tradewind Transport Flying-boat (four Allison T40 turboprop engines).



The Convair R3Y-2 Tradewind Transport Flying-boat (four Allison T40 turboprop engines).

Both the R3Y-1 and R3Y-2 were scheduled to go into service with the U.S. Navy's Fleet Logistic Wings, Pacific, in 1955.

DIMENSIONS.—
Span 145 ft. (44.2 m.).
Length 142 ft. 6 in. (43.5 m.).
Height (on beaching cradle) 51 ft. 5 in. (15.7 m.).

WEIGHTS.—
Loaded over 160,000 lb. (72,640 kg.).

PERFORMANCE.—
Max. speed over 350 m.p.h. (560 km.h.) at 25,000 ft. (7,620 m.).
Cruising speed about 300 m.p.h. (480 km.h.).
Rate of climb at S.L. 2,500 ft./min. (760 m./min.).
Max. Range 4,000 miles (6,400 km.).

THE CONVAIR B-58.

The B-58 multi-engined supersonic delta-wing bomber has been ordered into initial production for the U.S.A.F. The B-58, of which no details are available, is being built at Convair's Fort Worth plant.

THE CONVAIR B-36.

Production of the B-36 ceased in August, 1954, but all B-36's in service in the U.S.A.F. Strategic Air Command will be rotated through Convair every two years for modernisation.

The B-36 has been built in the following versions :—

XB-36. First prototype. Originally fitted with two 110-in. (2.79 m.) single main landing gear wheels, but later equipped with the multi-wheel main gears introduced on the B-36A. First flew on August 8, 1946.

YB-36. Production prototype. Roof of crew compartment raised above fuselage top line for improved vision, re-location of crew stations and installation of nose turret. First flew on December 4, 1947.

B-36A. Six 3,000 h.p. Pratt & Whitney R-4360-25 engines. First production model. Single main wheels of prototypes replaced by four-wheel bogies to reduce structure weight and improve weight distribution on runways. Twenty-two built. Originally without armament and used for training and type familiarisation. Modified into RB-36E (which see).

B-36B. Second production model. Six 3,500 h.p. Pratt & Whitney R-4360-41 engines with water-injection. Fully-equipped for combat with full armament. First flew on August 8, 1948. Last of 130 B-36B's modified by Convair to RB-36D standard, with additional jet power and installation of latest radar and electronic equipment, delivered to U.S.A.F. in December, 1951

B-36D. Third production model. B-36B with additional power primarily to increase speed over target area. Has four General Electric J47-GE-19 turbojet engines in podded pairs under outer wings to supplement the six 3,500 h.p. R-4360-41 engines. Prototype, a converted B-36B with four Allison J35 engines, first flew on March 26, 1949. Over-target speed of B-36D with J47 turbojets increased to over 435 m.p.h. (696 km.h.). Has new snap-action bomb-bay doors instead of sliding type used in earlier models. Maximum gross weight 358,000 lb. (162,390 kg.).

RB-36D. Long-range strategic reconnaissance version of B-36D. Same defensive armament. Fourteen cameras in forward bomb-bay. First flight on December 18, 1949.

RB-36E. B-36A modified for strategic reconnaissance. Re-engined with six 3,500 h.p. R-4360-41 engines and fitted with additional jet-power as for B-36D.

B-36F. Six 3,800 h.p. Pratt & Whitney R-4360-53 engines, plus four J47-GE-19 jet engines. Fourth production model.

RB-36F. Long-range reconnaissance version of B-36F.

B-36H. Six 3,800 h.p. Pratt & Whitney R-4360-53 engines plus four J47-GE-19 turbojets. Fifth production model, incorporating new two-station flight-engineer's panel and improved radar, electronic and night-lighting equipment.

RB-36H. Long-range reconnaissance version of B-36H.

B-36J. Six 3,800 h.p. Pratt & Whitney R-4360-53 engines, plus four General Electric J47-GE-19 turbojets. Sixth production model. Same power-plant as B-36H. Strengthened landing-gear. Maximum gross weight increased to over 400,000 lb. (181,600 kg.). Last production aircraft completed on August 14, 1954.

GRB-36. "Aircraft carrier." Formerly known as FICON (Fighter Conveyor) project. An undisclosed number of RB-36's are being converted into carriers for Republic RF-84F reconnaissance fighters, which can carry cameras or atomic weapons. GRB-36's are fitted with special gear to launch and retrieve the RF-84F's in the air. This combination has an operational radius of action of up to 5,000 miles (8,000 km.).

The following detailed information applies to the B-36J.

TYPE.—Ten-engined Heavy Bomber.

WINGS. — Shoulder-wing cantilever monoplane. NACA laminar-flow wing section. Aspect ratio 11. Wing mounted slightly forward of mid point of fuselage. All-metal structure with stressed skin. Leading-edge sweepback 15° 5′ 39″, trailing-edge sweepback 3°. Gross wing area 4,772 sq. ft. (443.3 m^2). Statically-balanced ailerons with controllable trim-tabs. Electrically-operated trailing-edge flaps in three sections on each side of fuselage. Total flap area 519 sq. ft. (48.2 m^2). Heated surface anti-icing.

FUSELAGE.— Circular section all-metal structure.

TAIL UNIT.—Cantilever monoplane type.

The Convair RB-36E Long-range Strategic Reconnaissance Monoplane. (*Warren Bodie*).

The Convair B-36J Long-Range Strategic Bomber (six 3,800 h.p. Pratt & Whitney R-4360 piston and four G.E. J47 turbojet engines).

All-metal structure. Tailplane span 73 ft. 5 in. (22.38 m.). Total horizontal area 978 sq. ft. (90.85 m.^{2}). Total vertical area 542 sq. ft. (50.34 m.^{2}). Thermal anti-icing in leading-edges of tailplane and fin.

LANDING GEAR.—Retractable tricycle type. Main gear consists of two four-wheel bogies on single shock-absorber struts, each unit retracting inwards into wing. Twin nose wheel gear raised forward into fuselage. Hydraulic retraction. Wheel track 46 ft. (14 m.), wheel base 59 ft. (18.0 m.).

POWER PLANT.—Six 3,800 h.p. Pratt & Whitney R-4360 twenty-eight cylinder radial air-cooled piston engines and four General Electric J47 turbojet engines (5,200 lb.=2,360 kg. s.t. each). Piston engines mounted as pushers aft of rear spars and drive Curtiss Electric three-blade constant-speed full-feathering and reversing propellers with hollow steel blades and thermal anti-icing. Propeller diameter 19 ft. (5.79 m.). Each engine fitted with two turbo superchargers. Inlets for induction and cooling air in and below leading-edge of wings. Turbojet engines are paired in pods under the outer wings. Wing fuel tanks with total capacity of over 30,000 U.S. gallons (113,400 litres). Oil capacity over 1,200 U.S. gallons (4,542 litres).

ACCOMMODATION.—Crew of sixteen, including 5-man relief crew. Pressurised crew compartments forward and aft of bomb-bay with pressurised intercommunication tunnel 85 ft. (25.9 m.) long and 25 in. (0.63 m.) in diameter on left side of fuselage and below wings. Four-wheel truck for passage through tunnel. Thermal anti-icing and de-frosting for pilot's and bombardier's compartments and for gun-sighting blisters in forward and rear crew compartments. Total pressurised fuselage volume 3,924 cub. ft. (111 m.^{3}).

ARMAMENT AND EQUIPMENT.—Six retractable remotely-controlled turrets, each mounting twin 20 mm. cannon, plus two 20 mm. cannon on flexible mounting in nose and two in radar-controlled tail turret. General Electric central fire-control system. Four-section bomb-bay with total volume of 12,300 cub. ft. (348 m.^{3}). Designed bomb load for 10,000 mile range, 10,000 lb. (4,540 kg.). Maximum bomb load 84,000 lb. (38,140 kg.).

DIMENSIONS.—
Span 230 ft. (70.14 m.).
Length 162 ft. (49.4 m.).
Height 46 ft. 9 in. (14.26 m.).

WEIGHTS AND LOADINGS.—
Max. gross weight over 400,000 lb. (181,600 kg.).
Wing loading 83.8 lb./sq. ft. (408.9 kg./m.^{2}).

PERFORMANCE.—
Max. speed over 435 m.p.h. (696 km.h.).
Stalling speed 95 m.p.h. (152 km.h.).
Service ceiling over 45,000 ft. (13,725 m.).
Max. designed range 10,000 miles (16,000 km.).
Take-off to 50 ft. (15.25 m.) 1,666 yards (1,523 m.).

THE CONVAIR 440 METROPOLITAN.

The Model 440 is a development of the 340 with modifications to increase speed (by about 5 m.p.h.=8 km.h.) and to reduce the noise level in the cabin. To improve performance the engine cowling, baffles and the "aspirated cooling" exhaust have been re-designed and aileron and flap seals have been fitted. The exhaust exit for each engine now consists of a single rectangular opening instead of the two circular exits found on the 340 and 240.

The cabin is provided with improved sound-proofing and, in addition, special inner window assemblies have been installed for the first eight rows of seats as an additional means to suppress engine, propeller and exhaust noise.

The Model 440 is offered in 44 and 52 seat versions. In the 52-seat version two extra rows of seats are installed in the forward cabin area.

Optional equipment includes a weather-detection radar nose.

At the time of closing for press orders for the Model 440 had been received from REAL (Brazil) (2), Continental Air Lines (3), S.A.S. (11), Aero O/Y (Finland) (1), Sabena (12), Swissair (8), National Airlines (6).

DIMENSIONS.—
Same as for Model 340.

WEIGHT.—
Max. T.O. weight (44 passengers, baggage and 1,313 U.S. gallons=4,963 litres fuel) 49,100 lb. (22,290 kg.).

PERFORMANCE.
Max. cruise range (no wind, 1,500 lb.=681 kg. fuel reserve, at 20,000 ft.=6,100 m. at max. T.O. weight as above) 1,310 miles (2,100 km.).
Max. cruise range (as above, but 52 passengers) under 1,000 miles (1,600 km.).

THE CONVAIR-LINER 340.

Although based on the Model 240, the Convair-Liner 340 is largely a new aircraft with greater wing span and area, a longer fuselage, more powerful engines, greater all-up weight and many interior design improvements.

The fuselage of the 340 is the same diameter as that of the 240 but is 54 in. (1.37 m.) longer, achieved by inserting a 16 in. (0.40 m.) section forward and a 38 in. (0.96 m.) section aft of the wings. This extra length permits the introduction of four additional seats, or it can be used for cargo purposes.

The first Convair 340 flew on October 5, 1951, and the first delivery to an airline—United Air Lines—was made on March 28, 1952.

Among the civil users of the Convair-Liner 340 are United Air Lines, Braniff Airways, Delta-C&S Air Lines, Continental Air Lines, National Airlines, Hawaiian Airlines, Aramco, Garuda Indonesian Airways, Finnish Air Lines (Aero O/Y), Philippine Air Lines, K.L.M., Aeronaves de Mexico, Cia. Mexicana de Aviacion, Avensa (Venezuela), Jugoslavenski Aerotransport (JAT), Servicos Aereos Cruzeiro do Sul (Brazil), Alitalia, REAL (Brazil), Lufthansa, Saudi Arabian Airlines, The Texas Company, Phillips Petroleum Company, Pratt & Whitney Aircraft, Union Oil Company, Union Carbide Company and Union Producing Company.

The Convair GRB-36 "Carrier" with a Republic RF-84F reconnaissance fighter in its launching position.

The Convair-Liner 340 Airliner (two 2,400 h.p. Pratt & Whitney R-2800-CB16 engines).

The last two Convair 340's built as civil aircraft were delivered to REAL (Brazil) in January, 1955, bringing the total number built up to that time to 206.

In April, 1955 it was announced that Saudi Arabian Airlines had ordered a further six Convair 340's This order was met from the C-131D production line, the U.S.A.F. having agreed to release six partly-finished airframes for this purpose.

One Convair 340 was acquired in 1954 by the British aero-engine manufacturer, D Napier & Son, Ltd. This aircraft has been fitted with two Napier Eland turboprop engines and is being used for test and demonstration purposes.

Type.—Twin-engined medium-range Airliner.

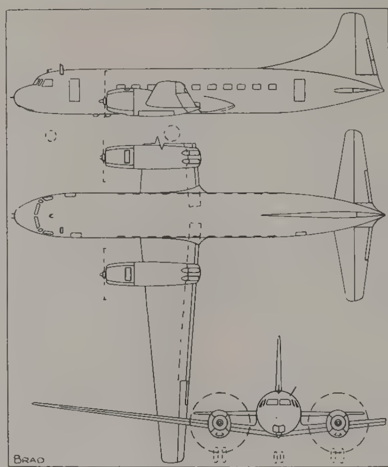
Wings.—Low-wing cantilever monoplane. All-metal structure with stressed-skin covering. Thermal anti-icing. Aspect ratio 12. Mean aerodynamic chord 9 ft. 8.6 in. (2.97 m.). Wing area 920 sq. ft. (85.5 m.^{2}).

Fuselage.—Circular section all-metal structure with stressed-skin covering.

Tail Unit.—Cantilever monoplane type. All-metal structure. Rudder and elevators fitted with trim and servo-control tabs. Thermal anti-icing for leading-edges of fin and tailplane.

Landing Gear.—Retractable tricycle type. All three units fitted with twin wheels. Steerable nose wheel with the two wheels keyed to common axle so that wheel and axle rotate as a unit to eliminate shimmy and need for damper. Both struts and wheels designed for installation of Westinghouse Decelostat anti wheel-skid units. Wheel track 25 ft. (7.62 m.).

Power Plant.—Two Pratt & Whitney R-2800-CB16 eighteen-cylinder radial air-cooled engines, each rated at 1,800 h.p. at 8,500 ft. (2,590 m.) in low blower and 1,700 h.p. at 14,500 ft. (4,240 m.) in high blower and with 2,400 h.p. available for take-off (with water injection). Engines mounted in aerodynamically-clean nacelles incorporating what is known as "aspirated cooling."



The Convair-Liner 340.

Air after passing through cylinder blocks enters a venturi section into which the exhaust gases are also ejected, the effect being to increase flow of cooling air. Air/exhaust mixture in a ratio of about 5/1 is ejected via twin tail-pipes above rear end of nacelle. Exhaust gas augmentation is claimed to give an increase in speed of about 10-12 m.p.h. (16-19.2 km.h.). Hamilton Standard Hydromatic constant-speed feathering and reversing airscrews, diameter 13 ft. 1 in. (4 m.). Integral fuel tanks outboard of engine nacelles. Maximum fuel capacity 1,750 U.S. gallons (6,615 litres). Provision for underwing refuelling.

Accommodation.—Crew of three/four. Cabin seats forty-four passengers in pairs on each side of central aisle. Integral self-contained stairway located forward of wings on port side. Cabin is pressurised and both air and sound conditioned. Radiant-wall heating and refrigeration maintains constant cabin temperature in the air and on the ground. Cargo compartment fore and aft of cabin, and below cabin floor forward of wings, with all access doors on starboard side.

Dimensions.—
Span 105 ft. 4 in. (32.12 m.).
Length 79 ft. 2 in. (24.14 m.).
Height (over tail) 28 ft. 2 in. (8.59 m.).
Wing area 920 sq. ft. (85.5 m.^{2}).

Weights and Loadings.—
Weight empty 29,486 lb. (13,382 kg.).
Max. gross take-off weight 47,000 lb. (21,338 kg.).
Max. landing weight 46,000 lb. (20,884 kg.).
Max. T.O. wing loading 51.08 lb./sq. ft. (249.27 kg./m.^{2}).
Max. T.O. power loading 9.8 lb./h.p. (4.44 kg./h.p.).

Performance.—
Cruising speed (1,200 h.p. per engine) at 18,000 ft. (5,490 m.) 284 m.p.h. (448 km.h.).
Range with 200 miles (320 km.) plus ¾-hour reserve; 1,200 h.p. per engine; 10 m.p.h. (16 km.h.) head wind; 44 passengers and baggage; 1,157 U.S. gallons (4,373 litres) of fuel 2,015 miles (3,225 km.).
Max. CAR operating height with one engine inoperative 9,000 ft. (2,745 m.).
Required CAR runway length for T.O. at max. T.O. weight 4,675 ft. (1,425 m.).
Required CAR runway length for landing S/L. at max. landing weight 4,500 ft. (1,370 m.).

THE CONVAIR-LINER 240.

The Convair-Liner 240 was the first post-war commercial transport designed by Consolidated Vultee and was evolved primarily to serve as a DC-3 replacement. The prototype first flew at San Diego on March 16, 1947, and the first licenced aircraft was delivered to American Airlines on February 28, 1948.

Approximately 175 Convair-Liner 240's were built, most of which were delivered to, and are still in service with, the following airlines:—American Airlines;

The Convair-Liner 240 Airliner (two 2,400 h.p. Pratt & Whitney R-2800-CA18 engines).

The Convair T-29B Aircrew Trainer (two 2,400 h.p. Pratt & Whitney R-2800 engines).

Western Air Lines; Pan American World Airways; Canadian Pacific Air Lines; Linee Aeree Italiane (LAI); K.L.M. (Royal Dutch Airlines); Trans-Australia Airlines; Aerolineas Argentinas; Orient Airways (Pakistan); Swissair; Sabena (Belgian Airlines); Northeast Airlines; Garuda Indonesian Airways and Ethiopian Airlines.

A full structural description of the 240 Convair-Liner has been published in previous editions of "All the World's Aircraft."

Type.—Twin-engined medium-range Air-liner.

Power Plant.—Two Pratt & Whitney R-2800-CA18 eighteen-cylinder radial air-cooled engine rated at 1,900 h.p. at 4,000 ft. (1,220 m.) in low blower and 1,675 h.p. at 13,500 ft. (4,120 m.) in high blower and with 2,400 h.p. available for take-off (with water injection). Either Hamilton Standard Hydromatic or Curtiss Electric constant-speed feathering and reversing air-screws, diameter 13 ft. 1 in. (4 m.). Integral fuel tanks outboard of engine nacelles. Maximum fuel capacity 1,550 U.S. gallons (5,860 litres).

Accommodation.—Crew of three/four. Cabin seats forty (40) passengers in pairs on each side of central aisle.

Dimensions.—
Span 91 ft. 9 in. (27.98 m.).
Length 74 ft. 8 in. (22.77 m.).
Height 26 ft. 11 in. (8.22 m.).

Weights and Loadings.—
Weight empty 27,600 lb. (12,530 kg.).
Payload 9,350 lb. (4,245 kg.).
Weight loaded 41,790 lb. (18,972 kg.).
Landing weight 39,800 lb. (18,070 kg.).
Wing loading (T.O.) 51.2 lb./sq. ft. (249.8 kg./m.^{2}).
Power loading (T.O.) 8.7 lb./h.p. (3.95 kg./h.p.).

Performance.—
Max. speed 347 m.p.h. (538 km.h.) at 16,000 ft. (4,880 m.).
Cruising speed 270 m.p.h. (432 km.h.) at 16,000 ft. (4,880 m.).
Landing speed (full flaps and power off) 88 m.p.h. (140 km.h.).
Service ceiling 30,000 ft. (9,150 m.).
Operational ceiling at 40,000 lb.=17,360 kg. on one engine 8,500 ft. (2,590 m.).
Range (with ATA reserve) at 270 m.p.h. (432 km.h.) cruising speed 1,800 miles (2,880 km.).

THE CONVAIR T-29.

In 1948 Convair began the military conversion of the Convair-Liner 240 to serve as an aircrew trainer for the U.S.A.F. under the designation T-29. The following versions of the T-29 have been or are being built:—

T-29A. Original Convair-Liner 240 crew trainer conversion. Non-pressurised but fitted with oxygen equipment for high-altitude training, permitting 6 hour's duration at 20,000 ft. (6,100 m.) at 250 m.p.h. (400 km.h.). Cabin has fourteen fully-equipped stations for students and one radio operator's station. Each student has access to a map table, Loran scope, altimeter indicator and radio compass panel. In roof of fuselage are four astrodomes. Five drift-meters also included. First T-29A flew for the first time on September 22, 1949. All T-29A's later modified with additional outer wing fuel tanks for increased range at operational height.

T-29B. Development of T-29A with pressurised cabin, increased fuel capacity and greater A.U.W. of 43,575 lb. (19,780 kg.) compared with 40,500 lb. (18,390 kg.) of T-29A. Major external difference is the fitting of three astrodomes and one periscopic sextant on top of fuselage instead of the four astrodomes of the A Series. First T-29B flew on July 30, 1952.

T-29C. Similar to T-29B but fitted with two advanced model 2,500 h.p. Pratt & Whitney R-2800 engines. Accommodation for 14 students and instructors. First T-29C flew on July 28, 1953.

T-29D. Similar to T-29C but equipped for advanced navigation/bombardment training. Accommodation for six students and two instructors. Training equipment for all phases of radar and optical bombing and navigation. Only external difference compared with T-29B is the absence of astrodomes. First T-29D flew on August 11, 1953.

VT-29E. This designation covers four Convair-Liner 240 personnel transports for MATS use. Two are furnished for V.I.P. use and two have standard high-density seating.

The following data refers specifically to the T-29B which is powered with two 2,500 h.p. Pratt & Whitney R-2800-99W engines.

The Convair T-29D Aircrew Trainer (two Pratt & Whitney R-2800 engines).

The Convair C-131A Samaritan Transport (two Pratt & Whitney R-2800 engines).

DIMENSIONS.—
Span 91 ft. 9 in. (27.98 m.).
Length 74 ft. 8 in. (22.77 m.).
Height over tail 27 ft. 3 in. (8.31 m.).
Wing area 817 sq. ft. (75.9 m.^{2}).

WEIGHT.—
T.O. weight 43,575 lb. (19,780 kg.).

PERFORMANCE.—
Max. speed 300 m.p.h. (480 km.h.).
Average cruising speed 230 m.p.h. (368 km.h.).
Stalling speed (with flaps) 92 m.p.h. (147 m./min.).
Initial rate of climb 1,370 ft./min. (418 m./min.).
Service ceiling 24,000 ft. (6,320 m.).
Service ceiling on one engine 7,500 ft. (2,290 m.).
Cruising range 1,500 miles (2,400 km.).
T.O. distance to 50 ft. (15.25 m.) 1,030 yds. (945 m.).
Landing distance from 50 ft. (15.25 m). 780 yds. (714 m.).

THE CONVAIR C-131.

The C-131A Samaritan is a military transport version of the Convair-Liner 240. It is the first pressurised twin engined air-evacuation transport to be ordered by the Military Air Transport Service.

The cabin can be arranged to carry 37 passengers in backward-facing seats or 27 stretcher cases, or several combinations of both. For loading stretchers a large hydraulically-operated door, opening upwards, is provided on the port side of the cabin aft of the wings. A standard Convair-Liner integral stairway which folds into the aircraft is located on the starboard side forward of the wings.

The C-131A is powered by two 2,500 h.p. Pratt & Whitney R-2800-99W engines.

DIMENSIONS.—
As for Convair-Liner 240.

WEIGHTS.—
Weight empty 29,000 lb. (13,166 kg.).
Weight loaded 43,575 lb. (19,783 kg.).

PERFORMANCE.—
Max. speed 313 m.p.h. (500 km.h.).
Stalling speed 95.4 m.p.h. (153 km.h.).
Initial rate of climb 1,410 ft./min. (430 m./min.).
Service ceiling 24,500 ft. (7,470 m.).
Service ceiling on one engine 7,100 ft. (2,165 m.).
Range with max. fuel (1,530 U.S. gallons = 5,780 litres) 1,600 miles (2,560 km.).
Take-off distance to 50 ft. (15.25 m.) 1,100 yds. (1,006 m.).

Whereas the C-131A described above is based on the Convair-Liner 240, there are several other aircraft in the C-131 series which are developments of the slightly larger Convair-Liner 340. These are :—

C-131B. This designation is applied to several aircraft which have been ordered by the U.S.A.F. for use as flying laboratories to test electronic equipment. They will either be used by the Air Force itself for research projects or assigned to firms engaged in the development of special electronic devices under Air Force contract. The C-131B is pressurised, has the Convair-Liner's integral passenger stairway forward of the wings, and is equipped with fittings to accommodate 48 passenger seats so that the aircraft can be quickly converted for transport duties. Large cargo door on port side of fuselage aft of wings for loading test equipment, etc. Provision for installation of radome beneath fuselage.

First C-131B flew for the first time on December 1, 1954.

DIMENSIONS.—
Same as for Convair-Liner 340.

WEIGHTS.—
Weight empty 29,000 lb. (13,166 kg.).
Weight loaded 47,000 lb. (21,340 kg.).

PERFORMANCE.—
Max. speed 305 m.p.h. (488 km.h.).
Cruising speed 276 m.p.h. (442 km.h.).
Service ceiling over 20,000 ft. (6,100 m.).
Range with max. fuel 1,900 miles (3,040 km.).

YC-131C. This designation covers two Convair-Liner 340's which are powered by two 3,750 h.p. Allison YT56-A-3 turboprop engines. They are intended for the test and evaluation of turboprop power-plants. The gross weight of the YC-131C is 53,200 lb. (24,153 kg.), and it is estimated that it will have a maximum speed of 335 m.p.h. (536 km.h.) and a cruising altitude of 30,000 ft. (9,150 m.).

The first YC-131C made its maiden flight on June 29, 1954.

C-131D. Military transport version of the Convair-Liner 340 for use in the Air Force's domestic transport service. 33 ordered. Last six to incorporate modifications for speed improvement and sound reduction introduced in Model 440 (which see).

TC-131E. Military cargo/personnel version of 340 for U.S.A.F. Strategic Air Command. Will incorporate sound-proofing and speed improvements introduced in Model 440 (which see). Extruded magnesium floor stressed to 300 lb./sq. ft. 10-foot cargo door on port side aft of wing. Integral passenger stairway.

RC-131F. Similar to TC-131E. Six for Military Air Transport Service (MATS).

The Convair YC-131C (two 3,750 s.h.p. Allison YT56 turboprop engines).

The Convair R4Y-1Z Naval Executive Transport (two Pratt & Whitney R-2800 engines).

RC-131G. Similar to RC-131F. One for Military Air Transport Service.

R4Y-1. Cargo / personnel / ambulance version of 340. Thirty-six for U.S. Navy. Reinforced plastic-covered extruded magnesium floor stressed to 300 lb./sq. ft. Tie-down rings in floor to withstand 5,000 lb. strain. 10-foot cargo door on starboard side. Integral passenger stairway. As personnel transport can carry 44 passengers in removable upholstered seats which can face either forward or backward. Seats are interchangeable with those used in R3Y flying-boat transport. Military bucket seats may also be installed. No galley or baggage compartment. Toilet at rear of cabin. As ambulance can carry 27 stretcher patients. Flight deck similar to 340.

R4Y-1Z. This is an executive transport version of the Convair-Liner 340 in service with the U.S. Navy. Seats 24 passengers and sleeps 6, plus crew. Based at the U.S. Naval Air Station, Anacostia.

CUSTER

CUSTER CHANNEL WING CORPORATION.

HEAD OFFICE: ROUTE 4, HAGERSTOWN, MARYLAND.

President and General Manager: W. R. Custer.

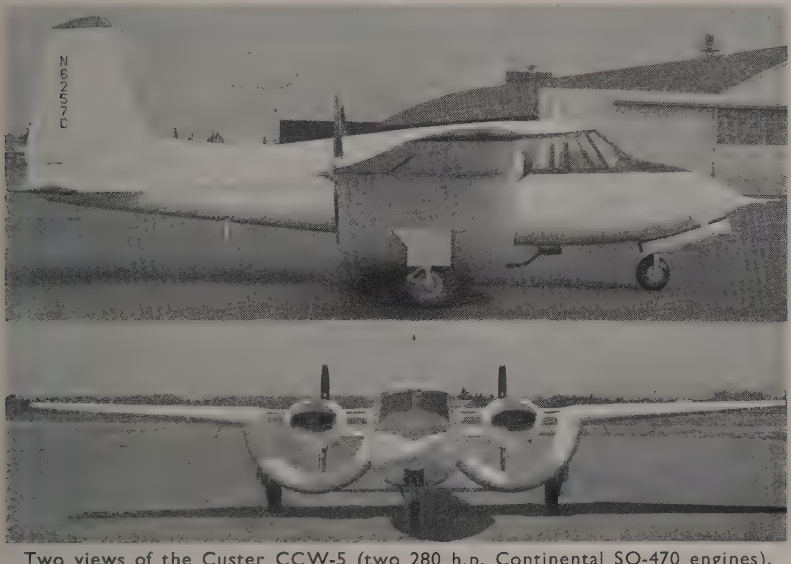
Vice-President: L. E. Roelke.

Secretary and Treasurer: Albert M. Davis.

The Custer Channel Wing Corpn. has been formed to develop a type of wing for which the company claims, among other things, that it will enable an aircraft to take-off in a few feet, rise vertically and hover; permit forward speeds in excess of those of conventional aircraft; and will allow an aircraft to slow down, hover and land vertically under full control.

An experimental aeroplane equipped with a channel wing with one-fifth the wing area of a conventional aeroplane of comparative size, was demonstrated in flight in December, 1951, and has since been flown for more than 300 hours.

The Custer CCW-5 Channel-wing Monoplane on its first flight.



Two views of the Custer CCW-5 (two 280 h.p. Continental SO-470 engines).

THE CUSTER CCW-5

The latest aircraft employing the channel wing is the CCW-5 which is, in effect, a modified five-seat Baumann Brigadier powered by two 225 h.p. Continental engines driving Hartzell constant-speed pusher airscrews. This aircraft, the general arrangement of which can be seen in the accompanying illustrations, was built by the Baumann Aircraft Corpn. for the Custer Channel Wing Corpn. It made its maiden flight at Oxnard, California, on July 13, 1953.

The CCW-5 is still undergoing tests at Oxnard. It is claimed that it has been flown at a speed as low as 11 m.p.h. (17.6 km.h.) under perfect control, has taken off at an all-up weight of 4,500 lb. (2,045 kg.), and using only 70 per cent. of power, in less than 90 ft. (28 m.), and has achieved a rate of climb of 3,000 ft./min. (915 m./min.).

DIMENSIONS.—
Span 41 ft. 2 in. (12.55 m.).
Length 28 ft. 8½ in. (8.76 m.).
Height 10 ft. 10 in. (3.30 m.).

WEIGHTS (designed).—
Weight empty 3,000 lb. (1,360 kg.).
Disposable load 2,400 lb. (1,090 kg.).
Weight loaded 5,400 lb. (2,450 kg.).

Two views of the de Lackner DH-4 Heli-Vector. On the right the engine is being started. (*Howard Levy*)

DE LACKNER HELICOPTERS, INC.

Head Office: 101, Main Street, Mount Vernon, New York.

President: Donald de Lackner.

de Lackner Helicopters, Inc. is responsible for building the Heli-Vector single-place helicopter which is shown in the accompanying illustrations.

THE DE LACKNER DH-4 HELI-VECTOR.

The DH-4 Heli-Vector, which made its first free flight on January 22, 1955, is a single-place helicopter in which the pilot and engine are located on a small platform above a pair of 15-foot (4.5 m.) contra-rotating rotors. Below the rotors are a central doughnut-type air-bag and four outrigged stabilising air-bags, which enable the Heli-Vector to take-off from and alight on both land and water.

The Heli-Vector is powered by a 30 h.p. Kiekhaefer Mercury two-stroke outboard motor which drives the rotors by means of two Vee belts. An automatic torque-balancing unit and a clutch to permit autorotation are incorporated in the rotor drive.

The pilot standing on the platform controls the Heli-Vector by leaning his body in the required direction. He is provided with a control column to which he is lightly strapped. The column is topped by a pair of handle-bars the movement of which turns the platform to face in the right direction. A twist-grip control operates the engine throttle.

The hollow control column serves as the fuel tank and has a capacity of 1 U.S. gallon (3.78 litres). Additional fuel can be carried in an auxiliary tank.

The prototype Heli-Vector weighs 180 lb. (81.7 kg.). It has an estimated top speed of 65 m.p.h. (104 km.h.) and a range of 15 miles (24 km.) on 1 U.S. gallon of fuel.

DOMAN

DOMAN HELICOPTERS, INC.

Head Office and Works: Municipal Airport, Danbury, Connecticut.

Established: August 31, 1945.

Chairman of the Board and Chief Engineer: Glidden S. Doman.

President: Donald S. B. Waters.

Director of Engineering: Thomas E. Zeerip.

Director of Research and Development: Stephen du Pont.

Chief Design Engineer: John W. Mazur.

Treasurer: Harry L. Brown.

Doman Helicopters, Inc., formerly known as Doman-Frasier Helicopters, Inc., was formed to develop a helicopter embodying new principles established by its engineers. These include a hingeless rotor unit in which the blades are dynamically flexible but otherwise unarticulated, a hydraulic rotor control system, and a rotor mechanism contained within a housing with circulating oil lubrication provided for all moving parts.

A complete rotor and control system designed and manufactured by the company was installed on a U.S.A.F. R-6 helicopter, and this combination, which is designated LZ-1A, has been stress and endurance tested under a service contract with the U.S.A.F. Wright Field Laboratories, and is still being flown as a test aircraft.

The first helicopter of completely Doman design, the LZ-4, was bought by the Curtiss-Wright Corporation.

The latest Doman helicopter, the LZ-5, has been ordered for service trials by the U.S. Army Field Forces. Doman also expects C.A.A. certification for the LZ-5 before the end of 1955.

A subsidiary known as Doman-Fleet Helicoptors has been formed by Doman and Fleet Manufacturing, Ltd. of Fort Erie, Ontario, Canada, to manufacture and market the LZ-5 helicopter in Canada.

THE DOMAN LZ-5.
U.S. Air Force designation: YH-31.

Type.—General Utility Helicopter.

Rotor System.—One four-blade main rotor and one three-blade anti-torque and steering tail rotor. Main rotor of hingeless type, articulation for aerodynamic flapping being provided by gimbal-mounting the hub. The hub is a four-spoked forging and above hub is a planetary reduction gear assembly. The sun gear is splined to the drive shaft, the ring gear is secured to the non-rotating gimbal ring and the planet carrier is attached to the rotor hub. A common housing encloses the reduction gearing, swash plate and rotor mechanism, with lubrication by circulating oil. Each blade has a spar of plastic bonded birch laminates and a plastic-bonded mahogany ply covering. Entire leading-edge is armoured with stainless steel and the trailing-edge is of extruded nylon which serves as a trim-tab. Near the root the bending and torsion loads of the laminated spar are transferred to a tubular steel spar, the root of which is secured in the hub housing by a bearing pack similar to propeller practice. Main rotor blade area (each) 18.4 sq. ft. (1.71 m.^{2}). Total disc area 1,810 sq. ft. (16.81 m.^{2}). Anti-torque rotor blades rigidly attached to gimbal-mounted hub. Total disc area of anti-torque rotor 63.6 sq. ft. (5.91 m.^{2}).

Fuselage.—Welded steel-tube structure covered with magnesium sheet.

Landing Gear.—Four-wheel type. Doman air-oil shock absorbers. Goodyear wheels and tyres. Track 7 ft. 2 in. (2.18 m.). Wheelbase 7 ft. 9 in. (2.35 m.).

Power Plant.—One 400 h.p. Lycoming S0-580-B eight-cylinder horizontally-opposed air-cooled engine mounted in nose of fuselage with crankshaft centre-line inclined up and aft at 32 degrees. Fluid drive with mechanical lock-up on engine crankshaft flange coupled to inclined tubular drive shaft equipped with universal joints. Tail rotor drive from take-off gear in main rotor. Main rotor/engine r.p.m. ratio 16.45 : 1. Anti-torque rotor/engine r.p.m. ratio 3.154 : 1. Fuel tankage in floor beam structure of main cabin section. Total fuel capacity 110 U.S. gallons (416 litres). Oil capacity 4 U.S. gallons (15 litres).

Accommodation.—Pilot's compartment in nose above engine seating two side-by-side. Cabin may seat up to six or accommodate four stretchers. Cabin is 8 ft. 4 in. (2.54 m.) long, 5 ft. (1.52 m.) wide and 5 ft. 11 in. (1.82 m.) high. Non-structural windowed side panels of cabin easily detachable for loading bulky objects. Side doors in panels for normal entrance.

Dimensions.—

Main rotor diameter 48 ft. (14.64 m.).

The Doman YH-31 Helicopter (400 h.p. Lycoming SO-580 engine).

Length of fuselage 37 ft. 10 in. (11.54 m.).
Overall width 5 ft. (1.52 m.).
Height (to top of rotor pylon) 10 ft. 3 in. (3.12 m.).
Anti-torque rotor diameter 9 ft. (2.74 m.).

WEIGHTS (YH-31).—
Weight empty 2,860 lb. (1,298 kg.).
Disposable load 1,559 lb. (708 kg.).
Weight loaded 4,419 lb. (2,006 kg.).

WEIGHTS (LZ-5 Commercial Model).—
Weight empty 2,860 lb. (1,298 kg.).
Disposable load 2,140 lb. (972 kg.).
Weight loaded 5,000 lb. (2,270 kg.).

PERFORMANCE (YH-31 at 4,419 lb. = 2,006 kg. A.U.W.).—
Max. speed 104 m.p.h. (166.4 km.h.).
Cruising speed 86 m.p.h. (137.6 km.h.).
Max. rate of climb 1,300 ft./min. (396 m./min.).
Hovering ceiling (no ground effect) 8,500 ft. (2,590 m.).
Hovering ceiling (in ground effect) 13,000 ft. (3,965 m.).
Service ceiling 18,000 ft. (5,490 m.).
Retrieving radius for two stretcher patients 240 miles (384 km.).
Max. endurance 3.7 hours.

PERFORMANCE (LZ-5 at 5,000 lb. = 2,270 kg. A.U.W.).—
Max. speed 98 m.p.h. (156.8 km.h.)
Cruising speed 86 m.p.h. (137.6 km.h.).
Hovering ceiling (no ground effect) 4,000 ft. (1,220 m.).
Hovering ceiling (in ground effect) 8,000 ft. (2,440 m.).

DOUGLAS

THE DOUGLAS AIRCRAFT COMPANY, INC.

HEAD OFFICE AND WORKS: SANTA MONICA, CALIFORNIA.

OTHER WORKS: EL SEGUNDO AND LONG BEACH, CAL, AND TULSA, OKLAHOMA.

Established: 1920. (Reorganized: 1928).

President: Donald W. Douglas.

Senior Vice-President: Frederick W. Conant.

Vice-President—Engineering: A. E. Raymond.

Vice-President—Commercial Sales: Nat Paschall.

Vice - President — Military Relations: Donald W. Douglas, Jr.

Vice-President—Public Relations: A. M. Rochlen.

Vice-President—Long Beach Division: K. G. Farrar,

Vice-President—Tulsa Division: Harry Woodhead.

Vice-President—Santa Monica Division: L. A. Carter.

Vice-President—El Segundo Division: T. E. Springer.

Executive Secretary: L. E. Tollefson.

Treasurer: Harry W. Strangman.

SANTA MONICA DIVISION.
General Manager: L. A. Carter.
Works Manager: H. W. Thue.
Chief Engineer: E. F. Burton.

EL SEGUNDO DIVISION.
General Manager: T. E. Springer.
Works Manager: R. A. Myers.
Chief Engineer: E. H. Heinemann.

LONG BEACH DIVISION.
General Manager: K. G. Farrar.
Works Manager: W. A. Burton.
Chief Engineer: Carlos C. Wood.

TULSA DIVISION.
General Manager: Harry Woodhead.
Works Manager: H. G. Hynd.
Chief Engineer: D. E. Dunlap.

The Douglas Aircraft Company has occupied the present factory site at Clover Field, Santa Monica, Cal., since 1928. It also operates plants at El Segundo, nine miles from the main plant, at Long Beach, 25 miles away and at Tulsa, Oklahoma.

Of the ten aircraft types in full production in the four division plants during 1954, eight were military types and two were civil transports.

The Santa Monica Division is responsible for the production of the DC-6 and DC-7. These, with the C-118 and R6D-1 Air Force and Naval versions of the DC-6, are being produced simultaneously on the same assembly line.

The El Segundo Division continued to manufacture the AD-5 and AD-6 Skyraider, the A3D-1 Skywarrior, the F4D-1 Skyray, and began production of the A4D Skyhawk.

The Long Beach Division continued production of the C-124C Globemaster II and initiated production of the B-66 and RB-66 for the U.S.A.F.

The Tulsa Division, a war-time bomber plant which was re-activated in 1951, is building the Boeing B-47 six jet bomber. The first B-47 completely built and assembled at Tulsa was delivered to the U.S.A.F. in July, 1953.

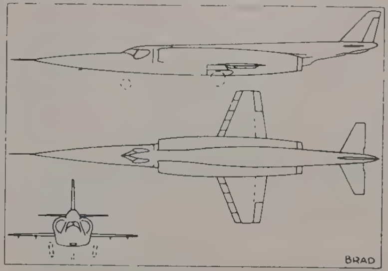
The Douglas company is engaged on an extensive programme of development which includes conventional military aircraft of advanced design, guided missiles, rockets, etc.

In the missile field, the Santa Monica factory is producing the Nike surface-to-air anti-aircraft rocket and the "Honest John" free-flight surface-to-surface rocket missile for the Army Field Forces.

THE DOUGLAS X-3.

The X-3 high-speed research aircraft, was designed and built by the Santa Monica Division under the joint sponsorship of the U.S.A.F., the U.S. Navy and the N.A.C.A. The project was directed by the Air Research and Development Command, U.S.A.F., to test design features of an aircraft suitable for sustained flights at extremely high altitudes. The contract was placed with Douglas by the U.S.A.F. in 1947.

More than sixty individual designs with all potential supersonic power-plants—separately and in various combinations—were considered before the combination of a mid-wing monoplane of unique proportions powered by two axial-flow turbojet engines was selected. The mock-up was completed in 1948 and construction began in 1949.



The Douglas X-3.

The design and construction presented problems of unprecedented complexity, involving not only aerodynamics but also the uses of new materials and construction methods. These included the development of fabrication and construction techniques with Titanium, used extensively throughout the X-3.

The loaded weight and overall length of the X-3 slightly exceed those of the DC-3 transport while the wing span is less than the span of the DC-3 tailplane.

The X-3 carries 1,200 lb. (545 kg.) of research instruments, many of them specially made for the aircraft and supplied by the N.A.C.A. Comprehensive instrumentation includes more than 850 "pin-hole" orifices to record pressures over various portions of the airframe. Temperature readings are registered at 150 points, while stresses and air loads are indicated by 185 electric strain gauges. An evaporator is used in conjunction with an air cycle refrigeration turbine to cool cockpit and instruments.

Information obtained in the design, development and flight tests of the X-3 is being made available to the aircraft industry through N.A.C.A. and military channels.

The X-3 was successfully test-flown on October 20, 1952, at the Edwards Air Force Base, Muroc, Cal. After a period of testing in the hands of Bill Bridgeman, chief pilot of the Douglas company, the X-3 was turned over to the N.A.C.A. for further research in December, 1953.

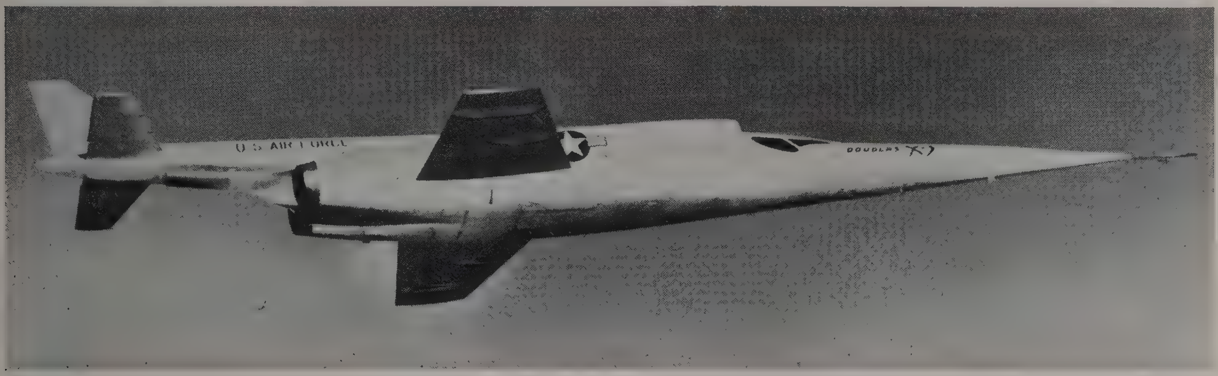
DIMENSIONS.—
Span 22 ft. 8 in. (6.91 m.).
Length 66 ft. 9 in. (19.34 m.).
Height 12 ft. 6 in. (3.81 m.).

THE DOUGLAS GLOBEMASTER II.

U.S.A.F. designation: C-124.

The Globemaster II transport has the ability to load without disassembly 95 per cent. of all types of Army Field Force's equipment. It has nose-loading doors with vehicle ramps, a rear cargo hatch with elevator loading and auxiliary floor for double deck loading.

The last Globemaster II was delivered to the U.S.A.F. on May 9, 1955. In five years 445 C-124's were built at the Long Beach plant.



The Douglas X-3 High-speed Research Monoplane.

The Douglas C-124A Globemaster II Transport (four 3,500 h.p. Pratt & Whitney R-4360 engines). (*Gordon Williams*).

The following versions of the Globemaster II have been mentioned :—

YC-124. Prototype. Four 3,000 h.p. Pratt & Whitney R-4360-35 engines driving four-blade airscrews. First flew on November 27, 1949.

C-124A. First production model. Four 3,500 h.p. Pratt & Whitney R-4360-20W engines driving Curtiss three-blade feathering and reversible airscrews 16 ft. 7 in. (5.06 m.) in diameter. Later fitted with thermal de-icing and APS-42 search radar as originally installed in C-124C.

YC-124B. One Globemaster fitted with four 5,500 h.p. Pratt & Whitney YT34-P-1 turboprop engines. Developed for Air Research and Development Command, U.S.A.F., to provide technical data on the operation of turboprop propulsive systems. Flew for the first time on February 2, 1954. Pressurised flight compartments for operation at altitudes up to 30,000 ft. (9,150 m.). Basic structure strengthened, vertical tail surfaces increased in size and strength and horizontal tail revised to make use of new and improved section. Span : 174 ft. 1½ in. (53.10 m.). Length 129 ft. 7 in. (39.52 m.). Height 51 ft. 3 in. (15.63 m.). A.U.W. 200,000 lb. (90,800 kg.).

C-124C. Four 3,800 h.p. Ford-built Pratt & Whitney R-4360-63 engines. Development of C-124A. Fitted with APS-42 search radar in nose radome. Second production model. Production ceased in April, 1955.

The following description refers to the C-124C.

Type.—Four-engined Military transport.

Wings.—Cantilever low-wing monoplane. Low-drag laminar flow aerofoil section. All-metal two-spar stressed-skin structure. Centre-section span 101 ft. 8 in. (30.99 m.). Full-span Fowler-type flaps, outer sections of which act as ailerons. Thermal de-icing with combustion heaters in streamline casings at wing-tips.

Fuselage. All-metal monocoque structure.

Tail Unit.—Cantilever monoplane type. All-metal structure with stressed skin over fin and tailplane and fabric covering on statically-balanced rudder and elevators. Trim-tab in rudder and trim and balance-tabs in elevators. Thermal de-icing on leading-edges of fin and tailplane with combustion heater in tail cone. Tailplane span 53 ft. 0 in. (16.15 m.).

Landing Gear.—Retractable tricycle type. All units have dual wheels. Track (centre-lines of legs) 34 ft. 2 in. (10.41 m.). Wheel base 37 ft. 3 in. (11.35 m.). Emergency bumper skid under rear fuselage.

Power Plant.—Four 3,800 h.p. Pratt & Whitney Wasp Major R-4360-63 twenty-eight-cylinder four-row radial air-cooled engines. Curtiss three-blade full-feathering and reversible airscrews, 17 ft. (5.18 m.) in diameter. Entry doors in wing root and in each nacelle allow inspection of engines in flight. Maximum fuel capacity 11,000 U.S. gallons (41.532 litres) carried in twelve integral wing tanks with all-electric fuel management controls and single-point manifold-type refuelling.

Accommodation.—Pilot's compartment seating two side-by-side in nose, with compartment immediately behind for flight-engineer, radio-operator and navigator. Galley, crew lavatory and relief crew compartment, with rest bunks, etc., further aft. Main cargo hold 77 ft. (23.48 m.) long, 12 ft. 10 in. (3.91 m.) high and 13 ft. (3.96 m.) wide, providing more than 10,000 cub. ft. (283 m.^{3}) of usable cargo space. Clamshell doors in nose ahead of nose-wheel provide an opening 11 ft. 8 in. (3.55 m.) high and 11 ft. 4 in. (3.45 m.) wide through which tracked or wheeled vehicles can be driven or rolled up built-in ramps. Electrically-operated elevator in middle of cargo hold, just aft of wing trailing-edge, provides additional loading and unloading facilities. Floor covered with 20 in. (50.8 cm.) grid pattern of heavy-duty tie down fittings. Two overhead travelling cranes, each lifting 8,000 lb. (3,629 kg.) or 16,000 lb. (7,258 kg.) run length of hold. For personnel transport interior of hold can be converted into a double-deck cabin with capacity for 200 troops and their field equipment. Fitted as an ambulance it can accommodate 127 stretcher cases, plus 52 sitting patients and medical attendants.

Dimensions.—
Span 174 ft. 1½ in. (53.10 m.).
Length 130 ft. 5 in. (39.77 m.).
Height 48 ft. 3½ in. (14.72 m.).

Weights.—
Payload 50,000 lb. (22,700 kg.).
Weight loaded 175,000 lb. (79,450 kg.).

Performance.—
No data available.

THE DOUGLAS XC-133A.

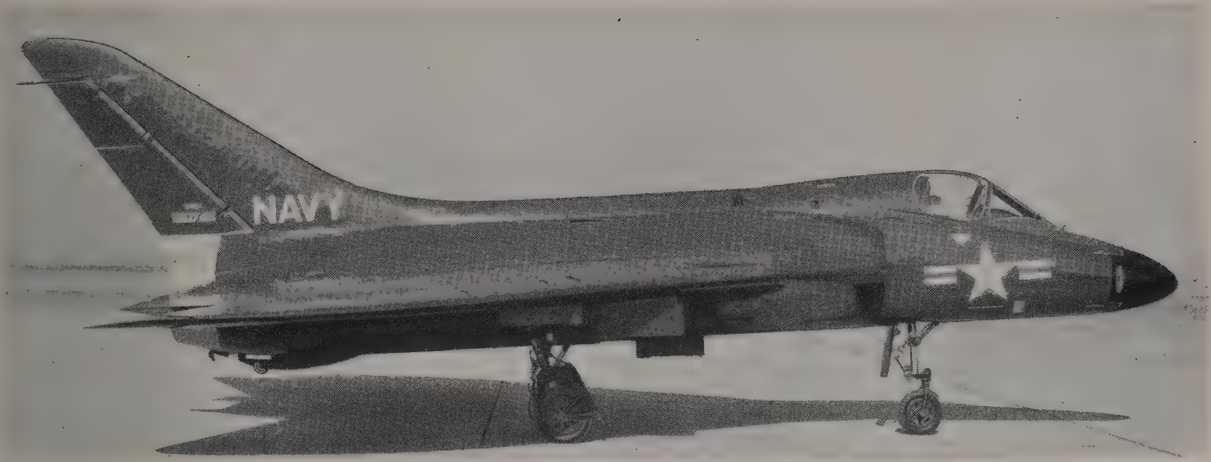
The XC-133A, now in production, will be an improved version of the YC-124B which has been designed to take full advantage of its turboprop power-plant. The many major modifications will include the removal of the main loading doors from the nose to the rear fuselage and a new rear fuselage and tail design. The entire fuselage will be pressurised and the wings and landing-gear strengthened.

THE DOUGLAS SKYRAY.

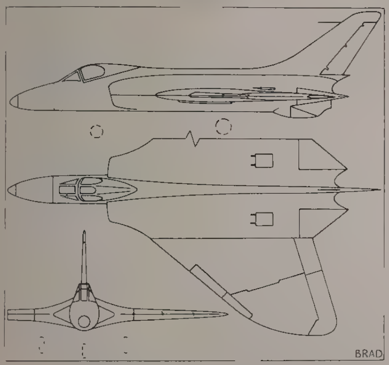
U.S. Navy Designation: F4D.

The F4D Skyray is a single-seat delta-wing tail-less monoplane which has been designed for the U.S. Navy as a supersonic carrier based interceptor fighter. The F4D was designed round the Westinghouse J40-WE-8 engine with afterburner, but

The Douglas C-124C Globemaster II Transport with nose loading doors open. (*Gordon Williams*).



The Douglas F4D-I Skyray Naval Carrier Fighter (Pratt & Whitney J57 turbojet engine).



The Douglas F4D Skyray.

owing to delays in the production of this engine the prototype XF4D-1 made its first flight on January 23, 1951, powered by an Allison J35-A-17 turbojet engine. It was later re-engined with the Westinghouse J40-WE-8.

The XF4D-1 successfully completed its carrier evaluation trials in the U.S.S. *Coral Sea* in the Autumn of 1953.

On October 3, 1953, the XF4D-1 powered by a Westinghouse J40-WE-8 engine with afterburner, set up a new World's Speed Record over the 3-km. course at Salton Sea, California, at 752.9 m.p.h. (1,211.746 km.h.).

Two weeks later, on October 16, the same aircraft covered the 100-km. 12-pylon closed circuit at Edwards A.F.B. at 728.11 m.p.h. (1,171.788 km.h.) to establish a new World's record for the distance.

The Skyray is now in production at the El Segundo Division and will continue in production into 1956. The production F4D-1 is powered by the Pratt & Whitney J57-P-2 turbojet engine (9,700 lb.=4,400 kg. s.t. without afterburner).

THE DOUGLAS SKYHAWK.

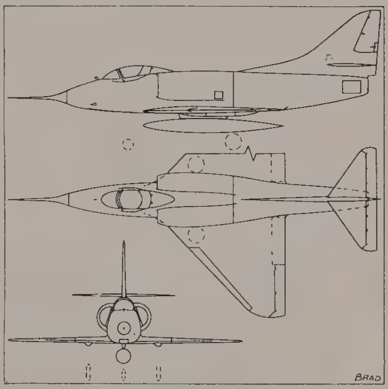
U.S. Navy designation: A4D.

The Skyhawk is a single-seat light-weight attack bomber which is less than half the size of, and is superior in performance to, many current operational jet fighters. It is the smallest and lightest U.S. jet-powered combat aircraft ever built.

Designed to operate from all sizes of aircraft-carriers and from short landing fields, the Skyhawk is capable of carrying atom bombs, or rockets, missiles and other weapons to suit the wide variety of missions of Attack-type aircraft. It is claimed that the Skyhawk will fly faster over greater distances with a more powerful strike load than any other aircraft of its type.

The Skyhawk is an all-metal low-wing monoplane of such dimensions that it will negotiate the standard aircraft carrier lift without the need for folding wings.

Designed on a completely functional basis with emphasis on simplification of structure and equipment, the first A4D was completed in eighteen months from the time the design work was started. As examples of weight-saving achieved, the air-conditioning system of the A4D is one-third the weight of the system previously used, while the pilot's ejector seat is almost one half the weight of the seat used in the A4D's predecessor. By design simplification the A4D gained 20



The Douglas A4D Skyhawk.

The Douglas A4D-I Skyhawk Attack Bomber (Wright J65 turbojet engine).

The Douglas A4D Skyhawk and XA3D-I Skywarrior at the Edwards Air Force Base, California.

per cent. more in speed and a third more in range than was at first thought possible.

The maiden flight of the XA4D-1 powered by a Wright J65-W-2 engine (7,200 lb.=3,270 kg. s.t.) took place on June 22, 1954, two weeks after the aircraft was completed. The production A4D-1 is powered with the J65-W-4 engine (7,800 lb.=3,540 kg. s.t.).

The general arrangement of the Skyhawk can be seen in the accompanying illustrations. No other details were available for publication at the time of closing for press.

THE DOUGLAS SKYWARRIOR.

U.S. Navy designation: A3D.

The A3D-1 is a twin-jet swept-wing carrier-based Attack Bomber which will be able to operate off carriers of the "*Essex*," "*Midway*" and "*Forrestal*" classes. The most powerful aircraft ever designed for carrier operation, the A3D can carry the largest types of bombs, including nuclear weapons. It can be used for high-altitude high-speed attack or for low-level attack or mine-laying. It can also be adapted for photographic reconnaissance duties.

The prototype XA3D-1 flew for the first time on October 28, 1952, powered with two Westinghouse J40 engines. It underwent extensive flight trials throughout 1953.

The A3D-1 Skywarrior powered by two Pratt & Whitney J57 engines is now in production at the El Segundo Division. The first production aircraft flew for the first time on September 16, 1953.

Type.—Twin-jet Attack Bomber.

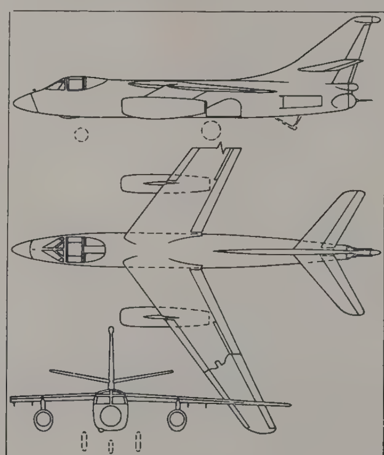
Wings.—Shoulder-wing cantilever monoplane. 36° sweepback at 25% of chord. Aspect ratio 6.75. Taper ratio 6% at root, 8.25% at tip. Dihedral nil. All-metal two-spar torsion-box type structure. Outer wings fold upward for carrier stowage. Hydraulically-operated NACA slotted flaps inboard of wing fold. Lateral control by combination of ailerons and spoilers on outer wings. Automatic leading-edge slats outboard of engine pod struts.

Fuselage.—All-metal structure in three sections, nose, centre and tail-cove. Air-brakes on sides of rear fuselage.

Tail Unit.—All-metal cantilever monoplane type. All surfaces swept. Vertical surfaces fold down for carrier stowage. Hydraulically-powered control system.

Landing Gear.—Retractable nose-wheel type. Nose-wheel retracts forward, main wheels sideways and backward, all into fuselage. Hydraulic actuation.

Power Plant.—Two Pratt & Whitney J57-P-12 turbojet engines (9,700 lb.=4,400 kg. s.t. each) in underwing pods. Fuel in four tanks, two self-sealing in fuselage, one forward and one aft of bomb-bay, and two integral wing tanks, one in each wing inboard of wing fold. Jettisonable T.O. rockets may be mounted on sides of rear fuselage.



The Douglas A3D Skywarrior.

Accommodation.—Crew of three, pilot and bombardier side-by-side and navigator/gunner behind pilot back-to-back, in pressurised cockpit. Emergency exit for all members of crew through floor escape chute of type first installed in F3D. Upper ditching hatch.

Armament.— Radar-directed Westinghouse ball-turret in rear end of fuselage armed with two 20 mm. cannon. Bomb-bay 15 ft. (4.57 m.) long adaptable to carriage of variety of offensive stores.

Dimensions.—
Span 72 ft. 6 in. (22.11 m.).
Length 74 ft. 5 in. (22.69 m.).
Height 22 ft. 9 in. (6.94 m.).

Weights.—
Weight loaded 70,000 lb. (31,780 kg.).

Performance.—
No data available.

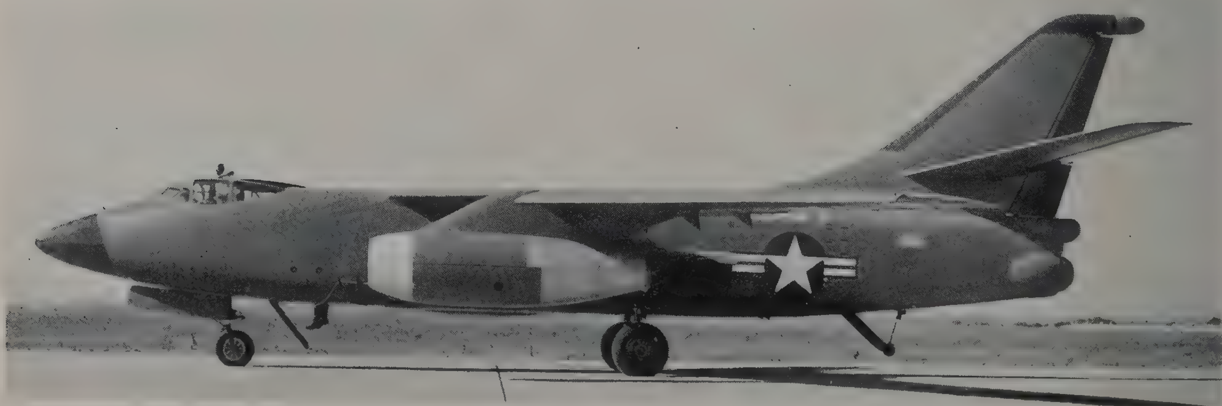
THE DOUGLAS B-66 and RB-66.

The B-66 three-seat high-performance light bomber, which is in production for the U.S.A.F., is based on the A3D previously described, with design and engineering changes to modify the carrier-based aircraft design into a land-based bomber. The production B-66 and a reconnaissance version, the RB-66, are powered by two Allison J71 turbojet engines.

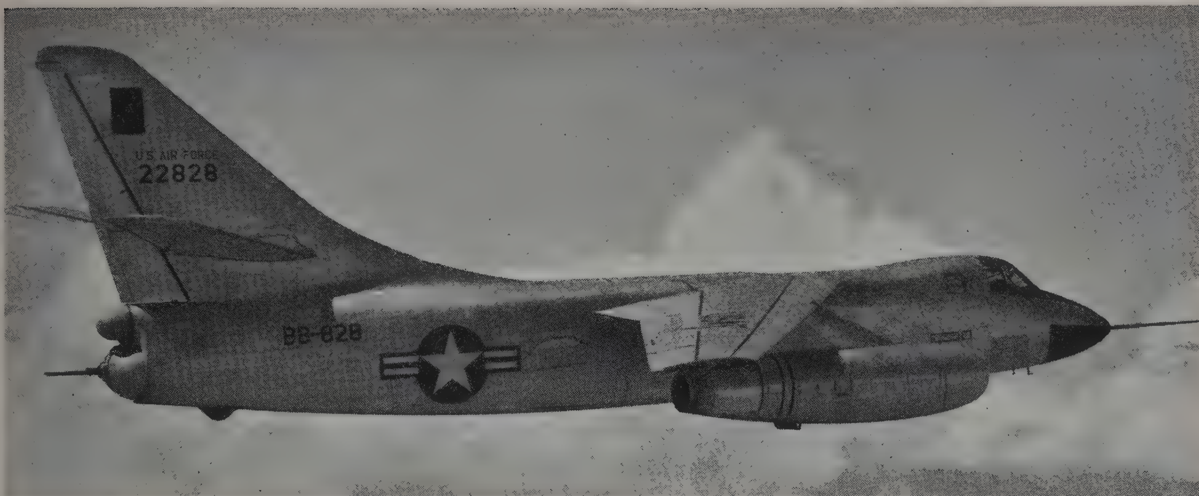
The first RB-66A made its first flight on June 28, 1954, and the first B-66B flew for the first time on January 4, 1955.

The RB-66 is in the 600-700 m.p.h. (965-1,126 km.h.) class, but no other performance data is available for publication.

The structural description given for the A3D can be assumed to apply in general to the B-66. The information given



The Douglas A3D-I Skywarrior Attack Bomber (two Pratt & Whitney J57 turbojet engines).



The Douglas B-66B Tactical Reconnaissance Monoplane (two Allison J71 turbojet engines).

below however refers primarily to the latter aircraft.

Type.—Twin-jet Bomber (B-66B) or Tactical Reconnaissance aircraft (RB-66A).

Wings.—As for A3D but without wing folding. Thermo-cyclic de-icing system. Areas: flaps (total 108.8 sq. ft. (10.11 m.^{2}), ailerons (total) 32.6 sq. ft. (3.03 m.^{2}). Gross wing area 780 sq. ft. (72.5 m.^{2}).

Fuselage.—Structure as for A3D.

Tail Unit.—As for A3D but vertical surfaces non-folding. Thermo-cyclic de-icing to fin and tailplane. Areas: fin 129.9 sq. ft. (12.07 m.^{2}), rudder 32.5 sq. ft. (3.02 m.^{2}), tailplane 114.8 sq. ft. (10.66 m.^{2}), elevators (total) 52.2 sq. ft. (4.85 m.^{2}).

Landing Gear.—As for A3D.

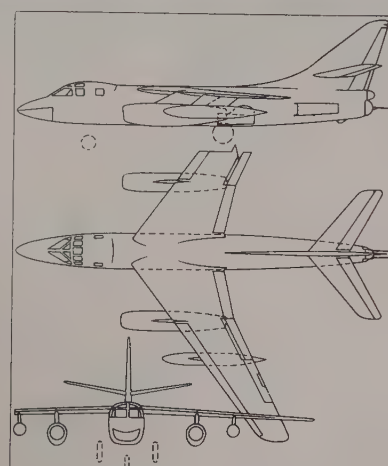
Power Plant.—Two Allison J71-A-11 turbojet engines (9,750 lb.=4,430 kg. s.t. each) in underwing pods. Normal fuel capacity 4,650 U.S. gallons (17,580 litres).

Accommodation.—Similar in arrangement to A3D.

Armament.—Two 20 mm. cannon in tail ball-turret. General Electric electronic fire-control system. Provision for wide selection of bomb combinations, including nuclear weapons, in internal bay (B-66B). Photographic equipment in RB-66A.

Dimensions.—
Span 72 ft. 6 in. (22.11 m.).
Length 75 ft. 2 in. (22.9 m.).
Height 23 ft. 7 in. (7.18 m.).

Weights (B-66B).—
Weight empty 40,330 lb. (18,293 kg.).



The Douglas B-66B.

Normal loaded weight 78,000 lb. (35,380 kg.).
Max. overloaded weight 83,000 lb. (37,648 kg.).

Weights (RB-66A).—
Weight empty 39,686 lb. (18,000 kg.).
Normal loaded weight 70,000 lb. (31,750 kg.).
Max. overloaded weight 79,000 lb. (35,834 kg.).

Performance.—
No data available.

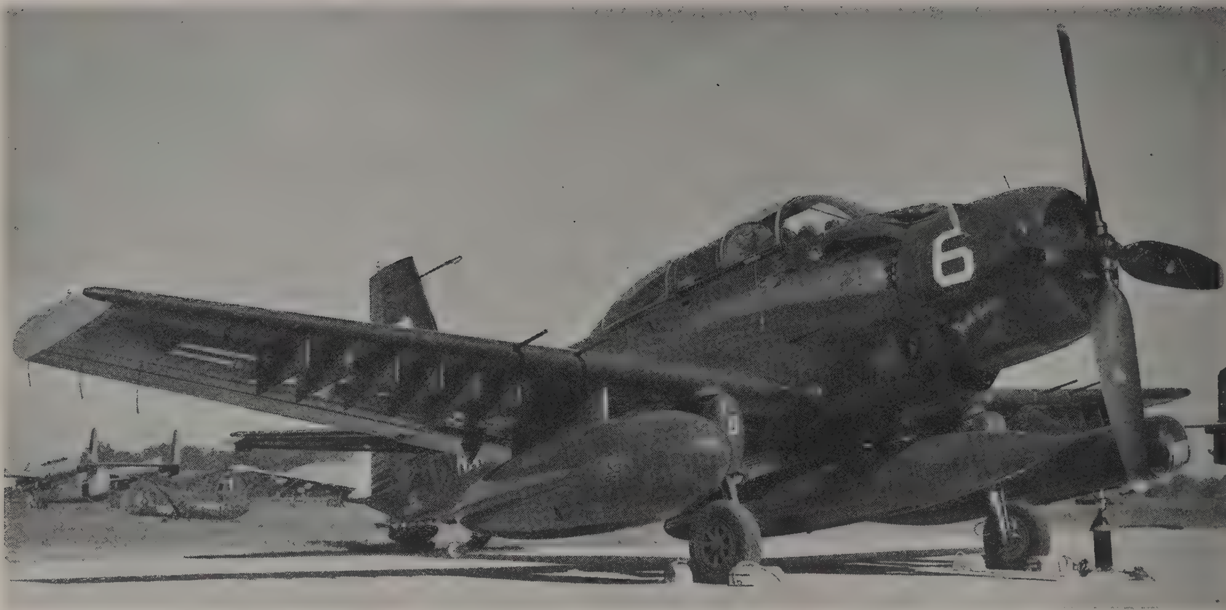
THE DOUGLAS SKYRAIDER.

U.S. Navy designation : AD.

The Skyraider was the third design conceived by the Douglas company to replace the SBD dive-bomber. Under the original designation XBT2D-1, the design was submitted to the U.S. Navy in July, 1944, and the prototype first flew on March 18, 1945. It went into production under the simplified Naval Attack designation AD. Since then the aircraft has undergone considerable development, resulting in the AD-2, AD-3, AD-4, AD-5 and AD-6, and a total of 49 versions of the six basic types has been produced.

The Skyraider has been in continuous production for ten years and U.S. Navy schedules call for production of the Skyraider to continue into 1957. Current production Models are the AD-6 and AD-7. On February 18, 1955, the 2,500th Skyraider—an AD-6—was delivered to the U.S. Navy.

A line of Douglas AD-6 Skyraiders, including the 2,500th Skyraider delivered to the U.S. Navy.



The Douglas AD-5N Three-seat Night Attack Monoplane (2,700 h.p. Wright R-3350 engine). (*Gordon Williams*).

Originally conceived in 1944 to carry a 1,000-lb. bomb, the Skyraider was operating in the Korean war with loads totalling 10,500 lbs., more than that carried by the four-engined B-17 Flying Fortress in World War II. The AD's conversion to carry atomic bombs was announced by the U.S. Navy Department in 1953.

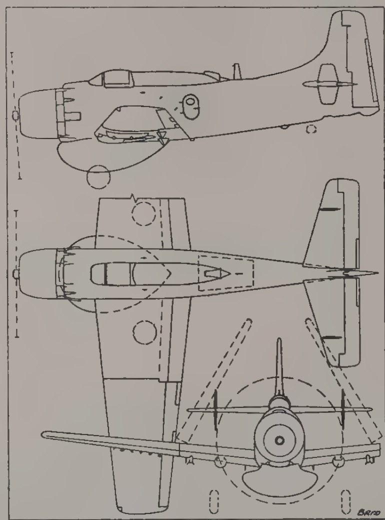
The following are the principal versions of the Skyraider :—

AD-1. 2,400 h.p. Wright R-3350-24 engine. First production series. Sub-types include (*a*) AD-1Q radar counter-measure aircraft with additional radar operator ; (*b*) AD-1W special search and early-warning radar aircraft with two additional radar operators ; and AD-1N night attack aircraft with two additional radar operators. All additional crews carried in rear fuselage.

AD-2. 2,700 h.p. Wright R-3350-26W engine. Increased performance and many internal refinements to give simplified control, improved vision, etc. AD-2Q (and AD-2Q (V) target tug), AD-2W and AD-2N tactical versions (see functions under AD-1).

AD-3. 2,700 h.p. Wright R-3350-26W engine. Strengthened landing-gear and longer-stroke oleo legs, improved canopy, etc., AD-3Q, AD-3W, AD-3N, AD-3S (anti-submarine) and AD-3E (special electronic equipment) versions.

AD-4. Development of AD-3. Redesigned cockpit, auto-pilot fitted, improved radar, etc. AD-4B modified to carry "special weapons" into production in 1952. Also AD-4Q, AD-4W and AD-4N special multi-seat tactical models. AD-4W in service with Royal Navy.



The Douglas AD-4W Skyraider.

AD-5. 2,700 h.p. Wright R-3350-26WA engine. "Multiplex" version permitting basic single-seat aircraft to be converted with standard kits to any one of twelve or more combat or tactical versions, including day or night attack, photographic reconnaissance, target-tug, -Q, -N, -W, and -S special radar-equipped multi-seaters, passenger-carrying (eight persons) and ambulance (four stretchers) versions. Redesigned fuselage with new wider cockpit to permit side-by-side seating, direct communication between crew members and complete interchange-ability of stations, larger vertical tail surfaces, etc. Normal loaded weight 18,800 lb. (8,535 kg.).

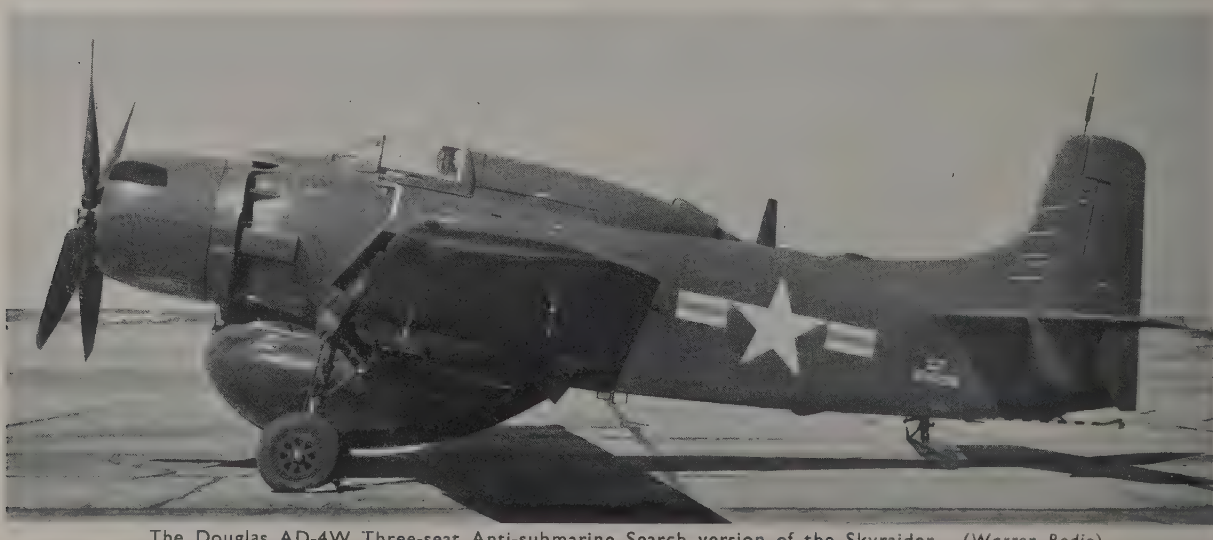
AD-6. 2,700 h.p. Wright R-3350-26WA engine. Improved AD-4 with special equipment for attack bombing. In production.

AD-7. Wright R-3350-26WB engine. In production.

The following description refers to the AD-6 :—

Type.—Single-seat Naval Attack monoplane.

Wings.—Low-wing cantilever monoplane. All-metal structure in three-main sections, comprising a centre-section and two upward-folding outer sections. Hydraulic folding controlled from cockpit. Gross wing area 400.33 sq. ft. (37.19 m.^{2}). All-metal ailerons on outer sections with trim



The Douglas AD-4W Three-seat Anti-submarine Search version of the Skyraider. (*Warren Bodie*).

and balance tabs in each. Hydraulically operated Fowler-type trailing-edge landing flaps on centre-section.

FUSELAGE.—All-metal monocoque structure with integral fin. The dive-brakes are components of the fuselage and consist of three rectangular surfaces, one on each lower side of the fuselage and one below, hinged at their forward ends in line with the trailing-edge of the wings. These surfaces are extended hydraulically outwards and downwards into the airstream.

TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering of movable surfaces. Electrically-controlled adjustable tailplane. Aerodynamically and statically balanced rudder and elevators. Trim and balance tabs in rudder.

LANDING GEAR.—Retractable two-wheel type. Main wheels on single compression legs are raised backwards and turn through 90 degrees while retracting to lie flat within wing. Hydraulic actuation. Forwardly-retracting tail-wheel. Deck arrester hook aft of tail wheel.

POWER PLANT.—One 2,700 h.p. Wright R-3350-26W eighteen-cylinder two-row radial air-cooled engine. Engine mounted at 4½° downthrust. Aeroproducts four-blade constant-speed airscrew 13 ft. 6 in. (4.11 m.) diameter. Single leakproof fuel cell occupies the entire fuselage bay aft of the pilot's cockpit. Long-range fuel tanks may be carried on the wing bomb shackles.

ACCOMMODATION. — Pilot's cockpit with blister-type blown canopy over fore part of wing with downward vision angle of 15 degrees. Full naval radio and radar equipment.

ARMAMENT.—Two 20 mm. cannon, one in each extremity of the centre-section inboard of the wing-fold hinges. Launchers for twelve 5 in. (12.7 cm.) zero-length and two 12 in. (30.5 cm.) "Tiny Tim" rocket projectiles under wings. Torpedo carried externally in crutches under the fuselage. Bomb racks under the fuselage and each outer wing.

DIMENSIONS.—Span 50 ft. 0$\frac{3}{16}$ in. (15.24 m.).
Width folded 24 ft. (7.32 m.).
Length 38 ft. 10½ in. (11.86 m.).
Height (over airscrew) 15 ft. 8 in. (4.77 m.).

WEIGHTS.—
Weight empty 10,550 lb. (4,790 kg.).
Normal loaded weight 18,106 lb. (8,220 kg.).
Max. overload weight 25,000 lb. (11,350 kg.).

PERFORMANCE.—
Max. speed 365 m.p.h. (584 km.h.) at 15,000 ft. (4,575 m.).
Initial rate of climb 2,850 ft./min. (870 m./min.).
Service ceiling over 25,000 ft. (7,620 m.).
Max. combat radius 1,500 miles (2,412 km.).

THE DOUGLAS DC-8.

The DC-8, production of which has begun, will be a four-jet swept-wing civil airliner with accommodation for from 80 to 125 passengers. The prototype will be ready for its initial flight by the end of 1957 and the production aircraft will be available for delivery by the beginning of 1959.

The DC-8 will be powered by four turbojet engines which will be mounted in pods beneath the 30° swept-back wings. The general arrangement of the DC-8 can be gathered from the illustration of a model appearing below.

The DC-8 will be available in both domestic and over-water versions with accommodation for up to 103 and 125 passengers respectively.

DIMENSIONS.—
Span 134 ft. 6 in. (41.0 m.).
Length 140 ft. 6 in. (42.85 m.).
Height 40 ft. 2 in. (12.25 m.).
Gross wing area 2,594 sq. ft. (241 m.^{2}).

WEIGHTS.—
Max. loaded weight (domestic) 211,000 lb. (95,707 kg.).
Max. loaded weight (over-water) 257,000 lb. (116,570 kg.).

PERFORMANCE.—
Max. cruising speed 554 m.p.h. (886 km.h.).

THE DOUGLAS DC-7.

The DC-7 is an evolutionary development of the DC-6 from which it differs mainly by having an 8 foot (2.44 m.) longer fuselage and a power-plant consisting of four 3,250 h.p. Wright Turbo Compound engines.

The DC-7 first went into service with American Air Lines on November 29, 1953.

TYPE.—Four-engined Airliner.

WINGS.— Low-wing cantilever monoplane. All-metal structure. Same as for DC-6. Gross wing area 1,463 sq. ft. (136 m.^{2}).

FUSELAGE. — All - metal semi - monocoque structure as for DC-6.

TAIL UNIT.—Cantilever monoplane type. Same structure and areas as for DC-6.

LANDING GEAR.—Retractable tricycle type. Same as for DC-6 except wheelbase 36 ft. 2 in. (11 m.).

POWER PLANT.—Four 3,250 h.p. (T.O.) Wright R-3350-18DA1 Turbo Compound eighteen-cylinder radial air-cooled compounded engines, each driving a four-blade Hamilton Standard high activity airscrew 13 ft. 6 in. (4.1 m.) diameter. Fuel in eight wing tanks. Fuel capacity 5,512 U.S. gallons.

ACCOMMODATION.—Similar to DC-6. Crew of three (domestic) or five (oversea) plus cabin attendants. Accommodation for 60 passengers, plus six lounge seats in de-luxe version, or up to 95 in coach version. Automatically controlled air-conditioning and pressurisation to provide S/L atmosphere at 12,500 ft. (3,810 m.) equivalent of 5,000 ft. (1,525 m.) at 20,000 ft. (6,100 m.) and equivalent of 8,000 ft. (2,440 m.) at 25,000 ft. (7,625 m.). All freight and baggage space below cabin floor. Total cargo capacity 743 cub. ft. (21.0 m.^{3}) or 14,200 lb. (6,441 kg.).

DIMENSIONS.—
Span 117 ft. 6 in. (35.81 m.).
Length 108 ft. 11 in. (33.24 m.).
Height 28 ft. 7 in. (8.72 m.).

WEIGHTS.—
Weight empty 66,306 lb. (30,076 kg.).
Payload (standard seating) 20,600 lb. (9,344 kg.).
Max. T.O. weight 122,200 lb. (55,429 kg.).
Max. landing weight 97,000 lb. (43,998 kg.).

PERFORMANCE.—

At 97,000 lb.=43,998 kg. A.U.W.
Max. speed 410 m.p.h. (656 km.h.) at 22,200 ft. (6,767 m.).
Max. cruising speed 365 m.p.h. (584 km.h.) at 24,400 ft. (7,437 m.).
Stalling speed 100 m.p.h. (160 km.h.).
Rate of climb at S.L. 1,760 ft./min. (536 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 990 ft./min. (302 m./min.).
Service ceiling 27,900 ft. (8,504 m.).
Ceiling on three engines 23,900 ft. (7,285 m.).

At 102,000 lb.=46,266 kg. A.U.W.
Max. speed 406 m.p.h. (653 km.h.) at 22,100 ft. (6,736 m.).
Max. cruising speed 360 m.p.h. (579 km.h.) at 24,300 ft. (7,406 m.).
Stalling speed 102.4 m.p.h. (164.8 km.h.).
Rate of climb at S.L. 1,620 ft./min. (494 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 870 ft./min. (265 m./min.).
Service ceiling 27,100 ft. (8,260 m.).
Ceiling on three engines 22,900 ft. (6,980 m.).

At 110,000 lb.=49,895 kg. A.U.W.
Max. speed 401 m.p.h. (645 km.h.) at 22,000 ft. (6,706 m.).
Max. cruising speed 349 m.p.h. (562 km.h.) at 24,000 ft. (7,315 m.).
Stalling speed 106.3 m.p.h. (171 km.h.).
Rate of climb at S.L. 1,520 ft./min. (463 m./min.).

A drawing of the Douglas DC-8 four-jet Airliner.

The Douglas DC-7 Airliner (four 3,250 h.p. Wright R-3350 turbo compound engines).

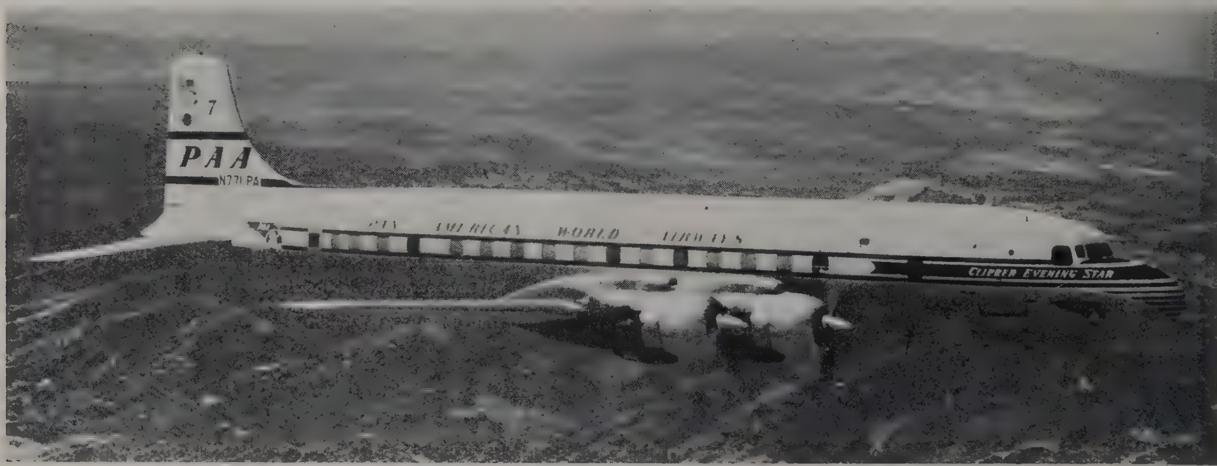
Rate of climb at 20,000 ft. (6,100 m.) 690 ft./min. (210 m./min.).
Service ceiling 25,900 ft. (7,894 m.).
Ceiling on three engines 21,400 ft. (6,523 m.).

RANGES.—
At 15,000 ft. = 4,575 m.
With 5,512 U.S. gallons (20,865 litres) fuel 4,430 miles (7,130 km.).
At 23,500 ft. = 7,163 m.
With 5,512 U.S. gallons (20,865 litres) fuel 3,905 miles (6,285 km.).

THE DOUGLAS DC-7B.

The DC-7B, the long-range intercontinental version of the DC-7 from which it differs in many respects.

The most important design change is a new flap linkage system which provides optimum position of the flap for take-off. By a re-location of the flap and vane with reference to the upper wing surface, the airflow characteristics over the flap have been improved, resulting in greater lift and reduced drag. The new flap permits shorter runway lengths at a given weight



The Douglas DC-7B Intercontinental Airliner (four Wright R-3350 turbo compound engines).

This view shows the latest engine cowling, spinners, etc. fitted to the DC-7B and DC-7C Airliners.

or increased useful load at the standard runway length for the aircraft.

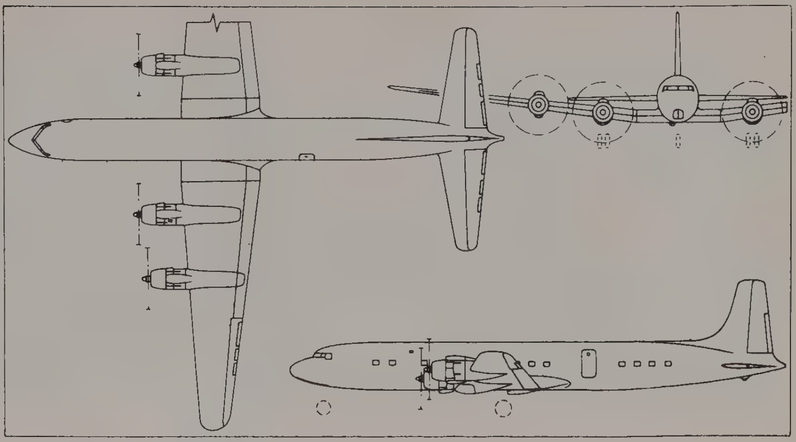
The fuel capacity has been increased from the 5,512 U.S. gallons of the DC-7 to 6,400 U.S. gallons by the addition of external saddle tanks which form part of the larger engine nacelles above the wing.

The power-plant of the DC-7B consists of four Wright Turbo Compound R-3350-18DA4 engines, each of which delivers 100 more METO horsepower than the earlier DA engines.

Cabin interiors will be available to accommodate from 40 passengers in a *de luxe* version to 95 passengers in the air-coach version.

DIMENSIONS.—
Same as for DC-7.

WEIGHTS.—
Weight empty 67,995 lb. (30,842 kg.).
Payload (standard seating) 22,650 lb. (10,274 kg.).
Max. T.O. weight 122,000 lb. (55,430 kg.).
Max. landing weight 102,000 lb. (46,265 kg.).



The Douglas DC-7C Seven Seas Airliner.

THE DOUGLAS DC-7C SEVEN SEAS.

The DC-7C is an improved version of the long-range DC-7B. It has a span of 127 ft. 6 in. (38.8 m.), 10 ft. (3.05 m.) more than that of the DC-7 and DC-7B. The extra span is added at the wing roots, the effect of which is to locate the inboard engines a further 5 ft. (1.5 m.) away from the fuselage. The increased span also gives space for additional fuel. The fuselage length has been increased by 40 in. (1.0 m.) forward of the wings. The vertical tail surfaces have been increased 2 ft. (0.6 m.) in height.

The DC-7C is powered by four 3,400 h.p. Wright R-3350-18EA1 Turbo compound engines. The fuel capacity is 7,860 U.S. gallons (29,711 litres).

Accommodation will be provided for up to 62 passengers in the de luxe version. 80 to 95 passengers can be carried in high-density arrangements. Cargo capacity of 650 cub. ft. is provided beneath the floor of the main cabin.

DIMENSIONS.—
Span 127 ft. 6 in. (38.8 m.).
Length 112 ft. 3 in. (34.23 m.).
Height 30 ft. 9 in. (9.37 m.).

WEIGHTS (typical loading).—
Manufacturer's weight empty 72,515 lb. (32,922 kg.).
Operating items (crew, cabin equipment, etc.) 5,402 lb. (2,452 kg.).
Operator's weight empty 77,917 lb. (35,374 kg.).
Passengers (62 at 165 lb. = 75 kg.) 10,230 lb. (4,645 kg.).
Cargo (at 10 lb./cub. ft.) 6,510 lb. (2,956 kg.).
Fuel (7,086 U.S. gallons = 26,785 litres) 42,517 lb. (19,303 kg.).
Oil (220 U.S. gallons = 823 litres) 1,650 lb. (749 kg.).
Take-off weight 139,000 lb. (63,106 kg.).

PERFORMANCE (Estimated).—
At 139,000 lb. = 6,3106 kg. A.U.W.
Max. speed 381 m.p.h. (610 km.h.) at 22,040 ft. (6,720 m.).
Cruising speed 304 m.p.h. (486 km.h.) at 23,300 ft. (7,106 m.).
Rate of climb at 20,000 ft. (6,100 m. (300 ft./min. (91.5 m./min.).
Service ceiling (4 engines) 22,800 ft. (6,954 m.).
Service ceiling (3 engines) 16,300 ft. (4,970 m.).
Take-off distance at S/L. (10% flap) 6,950 ft. (2,120 m.).
At 120,000 lb. = 54,480 kg. A.U.W.
Max. speed 398 m.p.h.(637 km.h.) at 22,500 ft. (6,860 m.).
Cruising speed 343 m.p.h. (549 km.h.) at 24,100 ft. (7,350 m.).
Rate of climb at 20,000 ft. (6,100 m.) 610 ft./min. (186 m./min.).
Service ceiling (4 engines) 26,100 ft. (7,960 m.).
Service ceiling (3 engines) 21,000 ft. (6,405 m.).
Take-off distance at S/L. 4,040 ft. (1,232 m.).
Take-off distance at 5,000 ft. (1,525 m.) 5,325 ft. (1,624 m.).
Absolute range at 15,000 ft. (4,575 m.) with 7,860 U.S. gallons = 29,711 litres of fuel 6,010 miles (9,616 km.).
Absolute range at 23,500 ft. (7,170 m.) with 7,860 U.S. gallons = 29,711 litres of fuel (1,800 h.p. per engine) 5,470 miles (8,750 km.).

THE DOUGLAS DC-6.

U.S. Air Force designation : C-118.

The DC-6 is a larger and more powerful development of, and successor to, the DC-4. Compared with the DC-4 it has a longer fuselage and a more powerful engine installation and included among its features are pressurised cabins for crew and passengers; roomier cabin, seats and berths; reversible-pitch airscrews and thermal de-icing for wings, tail and wind-shield. The DC-6 is still in production, mainly in the DC-6A and DC-6B versions (which see).

TYPE.—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23016-23012. Incidence at root 4°. Dihedral 7°. All-metal structure with smooth Alclad skin. NACA slotted flaps inboard of ailerons. Thermal de-icing.

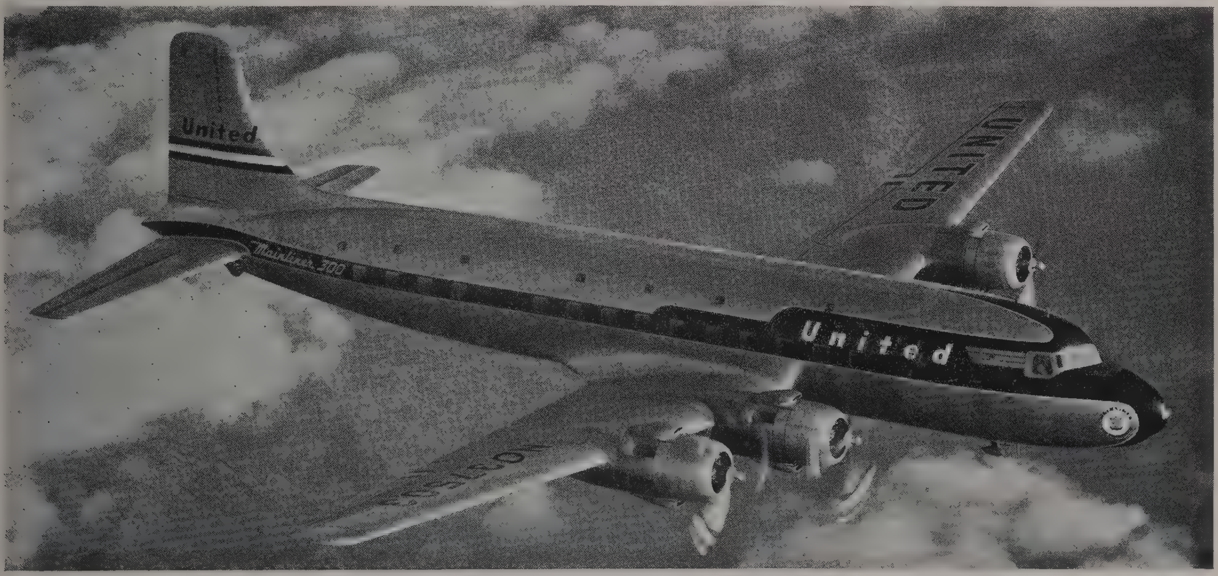
FUSELAGE. — Semi - monocoque all - metal structure with flush-riveted Alclad skin.

TAIL UNIT.—Cantilever monoplane type. Fin area 93.4 sq. ft. (8.67 m.²), Rudder area (aft of hinge, with tab) 49 sq. ft. (4.55 m.²), Total vertical area 159.9 sq. ft. (14.86 m.²), Tailplane area 210.9 sq. ft. (19.59 m.²), Elevator area (aft of hinge, with tab) 108.9 sq. ft. (10.11 m.²).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction with emergency manual gear. Hydraulic wheel brakes. Steerable nose wheel. Track 24 ft. 8 in. (7.52 m.). Wheel base 30 ft. 8 in. (9.34 m.).

POWER PLANT.—Four Pratt & Whitney Double-Wasp R-2800-CA15 eighteen-cylinder two-row radial air-cooled engines, each normally rated at 1,800 h.p. at 6,000 ft. (1,830 m.), 1,600 h.p. at 16,000 ft. (4,880 m.) and with a take-off output of 2,100 h.p. without or 2,400 h.p. with water injection. Hamilton Standard three-blade constant-speed full-feathering and reversible airscrews 13 ft. 1 in. (3.98 m.) diameter. Fuel capacity from 3,322 to 4,700 U.S. gallons (12,560 to 17,770 litres).

ACCOMMODATION.— Pressurised accommodation for crew and passengers. Passenger compartment seats 48 by day and for short-range can accommodate up to a maximum of 58. Entrance vestibule with



The Douglas DC-6 Airliner (four 2,100 h.p. Pratt & Whitney R-2800 CA15 engines).

The Douglas DC-6A Freighter (four 2,500 h.p. Pratt & Whitney R-280 engines).

coat-room and galley aft of wings with cabin space fore and aft. Upper and lower berths of 26 to 39 passengers may be fitted up in 30 seconds. Upper berths have separate air-conditioning controls. All berths have reading lights and storage space for clothing and toilet accessories. Men's lounge and toilet forward of main cabin, ladies' lounge, etc. aft of main cabin. Entire cabin space has fibre-glass sound-proofing and floors covered with foam-rubber-backed carpets. Pressurisation ensures cabin pressure altitude of approximately 5,000 ft. (1,525 m.) when flying at 16,000 ft. (4,880 m.), or 8,000 ft. (2,440 m.) when flying at 20,000 ft. (6,100 m.). Passenger cabin dimensions 64 ft. (19.5 m.) long 7 ft. 3 in. (2.2 m.) high. All freight and baggage space below cabin floor with new handling facilities to permit quick loading and unloading.

Dimensions.—
- Span 117 ft. 6 in. (35.81 m.).
- Length 100 ft. 7 in. (30.66 m.).
- Height (overall) 28 ft. 5 in. (8.66 m.).

Weights and Loadings.—
- Weight empty 51,495 lb. (23,380 kg.).
- Weight loaded 97,200 lb. (44,130 kg.).
- Wing loading 66.4 lb./sq. ft. (324 kg./m.^{2}).
- Power loading 10.1 lb./h.p. (4.58 kg./h.p.).

Performance.—
- Max. speed 356 m.p.h. (570 km.h.) at 19,600 ft. (5,980 m.).
- Cruising speed 313 m.p.h. (501 km.h.) at 20,400 ft. (6,220 m.).
- Landing speed 91 m.p.h. (145.6 km.h.).
- Rate of climb at S/L. 1,070 ft./min. (326 m./min.).
- Rate of climb at S/L. (one engine inoperative) 560 ft./min. (171 m./min.).
- Normal range 3,820 miles (6,112 km.).
- Max. range 4,610 miles (7,376 km.).
- Take-off distance to 50 ft. (15.25 m.) S/L. (no wind) 1,240 yds. (1,133 m.).
- Landing distance from 50 ft. (15.25 m.) 2,860 ft. (872 m.).
- Landing distance from 50 ft. (15.25 m.) with reversible airscrews 2,150 ft. (656 m.).

THE DOUGLAS DC-6A.

U S. Air Force designation: C-118A.
U.S. Navy designation: R6D-1.

The DC-6A is a freight-carrying version of the standard DC-6. It uses the wings, tail-unit and landing-gear of the DC-6 but has an entirely new fuselage incorporating features which experience has shown to be necessary for successful military and commercial cargo operation.

The new fuselage is 5 ft. (1.525 m.) longer than that of the DC-6, giving the DC-6A a total cargo space of 5,000 cub. ft. (141.5 m.^{3}). The main cabin, of constant cross-section throughout, is 68 ft. (20.74 m.) long, 7 ft. 9 in. (2.36 m.) high, and 8 ft. 9 in. (2.67 m.) wide at floor level. Two large doors, one forward and the other aft of the wings, are hinged at their top edges and swing upward to be clear of loading equipment. A self-powered loading elevator, which folds up for storage within the aircraft, can be attached to either front or rear cargo door and will lift 4,000 lb. (1,820 kg.) from truck-bed height to cabin floor level.

The DC-6A has automatically controlled cabin pressurisation and air-conditioning systems to permit high-altitude transportation of perishable cargoes.

Military DC-6A's under the designation R6D-1 are in production for the U.S. Navy and as C-118A's for the U.S.A.F.

The military versions, although primarily cargo transports, may be rapidly converted for passenger or troop carrying or air evacuation. In these forms they have accommodation for 60 passengers in rearward-facing seats, 76 on troop benches, or 40 stretcher cases.

Power Plant.—Four Pratt & Whitney Double-Wasp R-2800-CB17 eighteen cylinder radial air-cooled engines each developing 1,900 h.p. at max. continuous cruise and with 2,500 h.p. available for take-off with alcohol-water injection. Hamilton Standard or Curtiss Electric full-feathering and reversible airscrews. Standard fuel capacity 3,992 U.S. gallons (15,111 litres), with optional capacities of 5,406 U.S. gallons (20,550 litres) and 5,512 U.S. gallons (20,918 litres).

Dimensions.—
- As for DC-6 except Length 105 ft. 7 in. (32.20 m.).

Weights and Loadings.—
- Weight empty 49,767 lb. (22,595 kg.).
- Gross T.O. weight 106,000 lb. (48,125 kg.).
- Wing loading 72.5 lb./sq. ft. (353.8 kg./m.^{2})
- Power loading 10.6 lb./h.p. (4.81 kg./h.p.).

Performance.—(At 95,000 lb.=42,800 kg. gross weight).—
- Max. speed 360 m.p.h. (576 km.h.) at 18,100 ft. (5,520 m.).
- Cruising speed 307 m.p.h. (494 km.h.) at 22,400 ft. (7,390 m.).
- Landing speed 93 m.p.h. (149 km.h.).
- Initial rate of climb 1,120 ft./min. (374 m./min.).
- Initial rate of climb (one engine out) 620 ft./min. (203 m./min.).
- T.O. distance to 50 ft. (15.25 m.) at max. A.U.W. (no wind) 4,500 ft. (1,492 m.).
- Landing distance from 50 ft. (15.25 m.) 3,010 ft. (918 m.).
- Landing distance from 50 ft. (15.25 m.) with reversible airscrews 2,250 ft. (686 m.).
- Normal range 3,860 miles (6,176 km.).
- Max. range 4,910 miles (7,856 km.).

THE DOUGLAS DC-6B.

The DC-6B is a passenger version of the DC-6A. The larger fuselage offers approximately 7% greater payload capacity and 14% greater passenger capacity than the standard DC-6, with only 4% greater operating costs.

In 1953 six U.S. and seven foreign airlines took delivery of fifty-five DC-6B's. Orders in hand ensured continued production through 1954 and into 1955.

The standard domestic dayplane version of the DC-6B carries 64 passengers, eight more than the standard DC-6, while a trans-oceanic model with larger galleys, coatrooms and toilet compartments carries 54 passengers instead of the present DC-6 limit of 48. A high-density 92-passenger version with an air-coach type interior is also available.

The DC-6B is available with either the

The Douglas DC-6B Airliner (four 2,500 h.p. Pratt & Whitney R-2800 engines).

Pratt & Whitney R-2800-CB17 or R-2800-CB16 power-plants. With the CB17 power-plant the maximum take-off weight is 106,000 lb. (48,125 kg.) and the performance is the same as for the DC-6A. With the CB16 power-plant which has 2,400 h.p. available for take-off, the maximum take-off weight is 100,000 lb. (45,400 kg.) and the corresponding take-off distance over a 50 ft. (15.25 m.) obstacle with no wind is 3,780 ft. (1,153 m.). The cruising and landing performance are the same as for the DC-6A. The empty weight of the standard DC-6B is 54,148 lb. (24,583 kg.) and the maximum landing weight is 88,200 lb. (40,043 kg.).

The version of the DC-6B supplied to Pan American World Airways has been specially modified for use on that operator's tourist class services. Pan American has acquired a fleet of forty-five aircraft of this type, which it calls the Super 6.

The Super 6, which has been certificated for a gross take-off weight of 107,000 lb. (48,580 kg.), carries a greater payload, has an increased fuel capacity and an improved performance. It has a standard accommodation for 82 passengers for trans-Atlantic tourist class operations.

FAIRCHILD

THE FAIRCHILD ENGINE AND AIRPLANE CORPORATION.

EXECUTIVE OFFICE: HAGERSTOWN, MARYLAND.

Chairman of the Board: James A. Allis.

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Vice-President and General Manager, Engine Division: George F. Chapline.

Vice-President and General Manager, Aircraft Division: Willard L. Landers.

Vice-President and General Manager, Stratos Division: F. E. Newbold, Jr.

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Vice-President: Paul J. Frizzell.

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Assistant General Manager: O. A. Berthiaume.

Director of Engineering: Louis Fahnestock.

Chief Engineer: Walter Tydon.

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General Manager: George F. Chapline.

Assistant General Manager: Evard M. Lester.

Chief Engineer: Alfred T. Gregory.

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Divisional Office and Works: Wyandanch, Long Island, N.Y.

General Manager: Edwin A. Speakman.

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Divisional Office and Works: Bay Shore, Long Island, N.Y.

Assistant General Manager: J. W. Livingston.

Chief Engineer: D. O. Moeller.

General Manager: F. E. Newbold, Jr.

AMERICAN HELICOPTER DIVISION

Divisional Office and Works: Manhattan Beach, Cal.

General Manager: P. J. Frizzell.

Director of Operations: Howard E. Roberts.

Chief Engineer: Nicholas M. Stefano.

The Fairchild Engine and Airplane Corporation was formed in 1936 to acquire from the Fairchild Aviation Corporation its aeroplane and aero-engine manufacturing subsidiaries.

The Fairchild Aircraft Division is engaged in the production of the Fairchild C-123B Assault Transport for the U.S. Air Force.

The C-82 and C-119 are both in service in large numbers in the U.S.A.F., the C-82 by Air Defence Command and by Air Rescue units, and the C-119 in all the major commands of the U.S.A.F.

The C-119 is also being used by the U.S. Marine Corps, by the Royal Canadian Air Force and the air forces of Belgium, Italy and India.

The Fairchild Engine Division is engaged in research and development work for the U.S. Navy and Air Force. Several unique types of power-plant, most of them classified, are either in the production or in the experimental development stage.

The Guided Missiles Division is developing and producing guided missiles and missile guidance and launching systems for the Bureau of Aeronautics of the U.S. Navy. It also is producing missiles for the U.S. Air Force and U.S. Army.

The Stratos Division specializes in the design and production of pressurization and cooling equipment for aircraft. The division is producing in volume compact air cycle refrigeration units for use in high-speed jet aircraft.

The American Helicopter Division, the former American Helicopter Company, Inc., is engaged in the development and manufacture of pulse-jet helicopters and moulded plastic aircraft components.

In 1952 the Fairchild Engine and Airplane Corporation acquired an option on licences to build the Fokker S.11, S.12, S.13, S.14 and F.27 from the N.V. Koninklijke Nederlandsche Vliegtuigenfabriek Fokker.

THE FAIRCHILD PACKET.

U.S. Air Force designations: C-82 and C-119.
U.S. Marine Corps designation: R4Q.

The original design of the Packet was begun in 1941 and the design and mock-up were approved by the U.S. Army in 1942. The prototype, under the designation XC-82, first flew on September 10, 1944.

The C-82 was put into production before the end of the war and a total of 220 aircraft of this type had been built by Fairchild by September, 1948, when production on this model ceased.

Late in 1947 a new and improved version of the C-82 made its first flight. This version, designated C-119, has been the subject of considerable development. The principal change introduced in the C-119 was the re-location of the flight deck from the former position on the top of the fuselage to the nose to give improved vision ahead and below for formation flying during troop and supply dropping. The fuselage is 14 in. (35.6 cm.) wider and wings of greater strength permit an increase in the maximum permissible gross weight to 77,000 lb. (34,960 kg.). The capacity of the freight hold has been increased to 2,700 cub. ft. (76 m^3).

The following are the production versions of the Packet:—

C-82A. Two 2,100 h.p. Pratt & Whitney R-2800-85 engines. Production model of the XC-82. Out of production in September, 1948.

C-119B. Two Pratt & Whitney R-4360-20 twenty-four cylinder radial engines with two-stage blowers, rated at 2,650 h.p. to 6,000 ft. (1,830 m.), 2,300 h.p. at 18,000 ft. (5,480 m.) and with 3,250 h.p. available for take-off. First production version of C-119.

C-119C. Two Pratt & Whitney R-4360-20W engines developing 3,500 h.p. for take-off. Dorsal fins added to booms.

R4Q-1. U.S. Marine Corps version of C-119C. The two versions are identical.

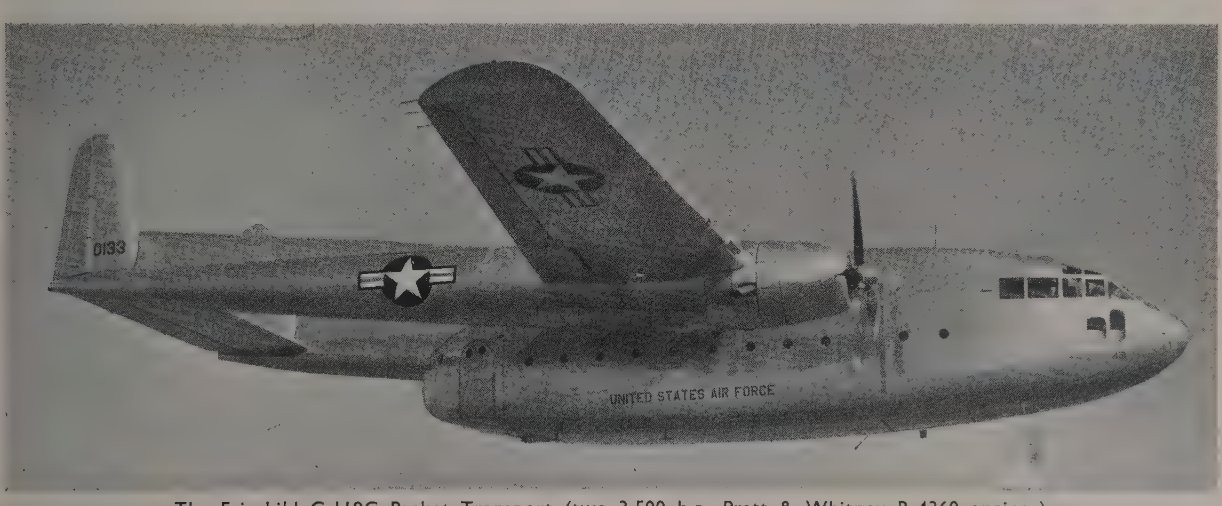
C-119F. Similar to C-119C but fitted with two 3,500 h.p. Wright R-3350-32W Turbo Cyclone engines and Hamilton Standard airscrews. Small lower fins added.

R4Q-2. U.S. Marine Corps version of C-119F.

C-119G. As C-119F but with Aero-Products airscrews.

TYPE.—Twin-engined Cargo and Troop Transport.

WINGS.—Cantilever high-wing monoplane. Two-spar all-metal structure in three main sections consisting of anhedral centre-section set into fuselage and carrying engine nacelles and tail booms and two outer wings. Detachable tips. Metal ailerons on outer wings. Thermal de-icing. Total area of ailerons 112 sq. ft. (10.4 m^2). Total area of flaps 100 sq. ft. (9.3 m^2). Gross wing area 1,447 sq. ft. (134.4 m^2).



The Fairchild C-119C Packet Transport (two 3,500 h.p. Pratt & Whitney R-4360 engines).

The Fairchild C-119G Packet Transport (two 3,350 h.p. Wright R-3350 engines).

Fuselage. — All-metal semi-monocoque structure. Structure consists of Alclad vertical frames, longitudinal stringers and longitudinal and transverse beams, with Alclad skin. Seven longitudinal beams take the floor and tie-down loads beneath a ply-covered floor.

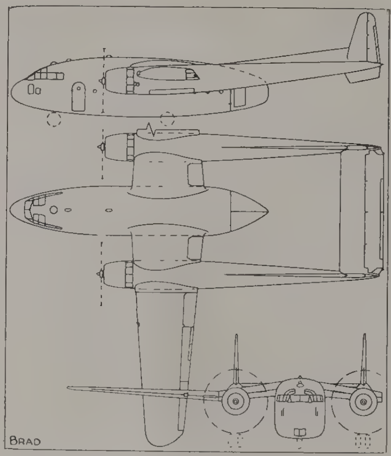
Tail Booms.—All-metal structures. Each in two main sections. Forward section bolted to engine nacelle structure aft of trailing-edge. Aft section is bolted to forward section at leading-edge of tailplane.

Tail Unit.—Cantilever monoplane type with twin fin and rudders. All-metal structures. Tailplane and fins have stressed metal skin covering; one-piece metal framed elevator and rudders have metal noses and fabric covering over all. Controllable trim-tabs in elevator and rudders, latter also having spring-loaded tabs. Thermal de-icing for all fixed tail surfaces. Areas: vertical fins without dorsal and ventral additions 87.4 sq. ft. (8.12 m.^{2}), rudders 42.4 sq. ft. (3.94 m.^{2}), tailplane 232.4 sq. ft. (21.6 m.^{2}), elevators 113.8 sq. ft. (10.6 m.^{2}).

Landing Gear.—Retractable tricycle type. Electrical actuation. In emergency, the clutch at the electric actuators is released to allow the gears to "free fall" into the down position. Hydraulic brakes on main wheels.

Power Plant.—Two 3,500 h.p. Pratt & Whitney R-4360-20W (C-119C) or Wright R-3350-32W (C-119F and C-119G) radial air-cooled engines. Hamilton Standard Hydromatic (C-119C and C-119F) or Aero-Products (C-119G) four-blade constant-speed and reversing air-screws. Total fuel capacity 2,624 U.S. gallons (9,920 litres).

Accommodation.—Flight deck has two seats side-by-side for pilot (on port) and co-pilot; navigator's seat and table are on starboard side of the aircraft; the radio operator is centrally located behind the pilot and co-pilot. A crew chief's seat is provided behind the pilot over the entrance hatch. Individual oxygen equipment for all members of crew. Access to the flight deck is by a ladder on the port side. The aircraft is equipped as a troop transport, ambulance or medium cargo transport. An electrically-operated monorail discharges paracans through a hatch in the bottom of the fuselage. Ramps provided to load wheeled or tracked equipment. Heavy reinforced floors are at truck bed level. Rear cargo doors open on vertical hinge line providing entrance opening as wide and high as cargo hold. Small door in each main cargo door for simultaneous jumping of two sticks of paratroopers. Interior dimensions of cabin or hold: Length 36 ft. 11 in. (11.25 m.). Width 9 ft. 10 in. (3.0 m.). Height 8 ft. (2.44 m.). Floor area 353 sq. ft. (32.8 m.^{2}). Volume 3,150 cub. ft. (88.2 m.^{3}). Normal seating capacity 67. Maximum seating capacity (emergency evacuation) 78. Stretcher patients 35. Monorail capacity 20 bundles each weighing 500 lb. (227 kg.). Glider tow capacity one 30,000 lb. (13,620 kg.) glider.



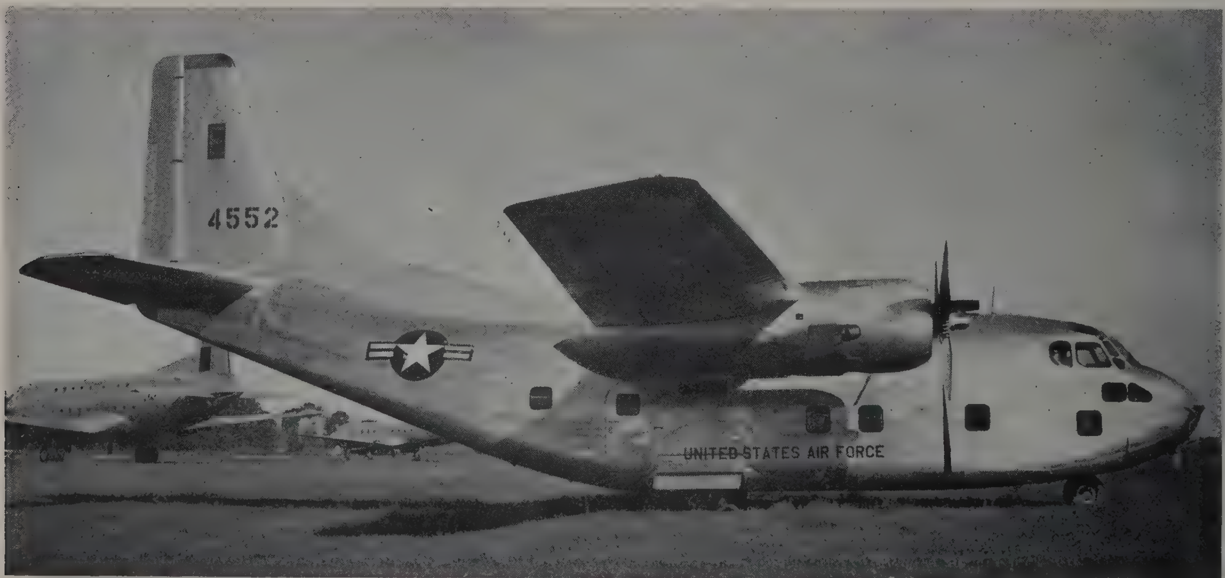
The Fairchild C-119F Packet.

Dimensions.—
- Span 109 ft. 3 in. (33.32 m.).
- Length 86 ft. 6 in. (26.38 m.).
- Height 26 ft. 3 in. (8.0 m.).

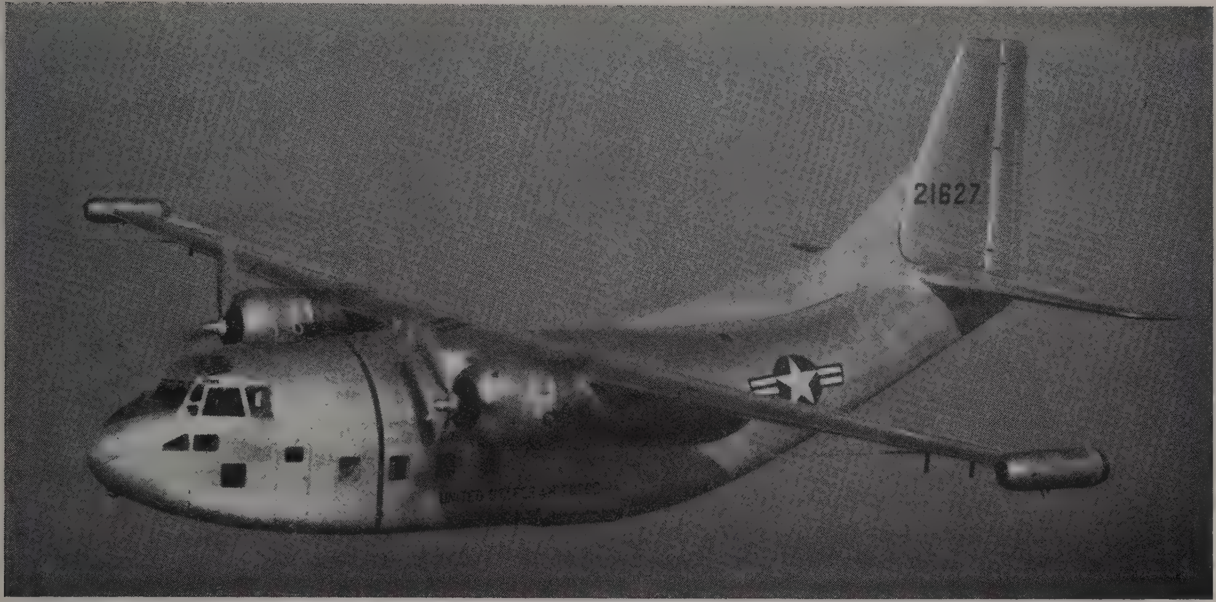
Weights and Loadings (C-119C).—
- Weight empty 39,942 lb. (18,134 kg.).
- Payload 27,500 lb. (12,485 kg.).
- Max. T.O. weight 73,150 lb. (33,210 kg.).
- Wing loading 50.5 lb./sq. ft. (246.4 kg./m.^{2}).
- Power loading 10.5 lb./h.p. (4.76 kg./h.p.).

Weights and Loadings (C-119F).—
- Weight empty 39,809 lb. (18,083 kg.).
- Payload 28,000 lb. (12,712 kg.).
- Max. T.O. weight 72,800 lb. (33,050 kg.).
- Wing loading 50.5 lb./sq. ft. (246.4 kg./m.^{2}).
- Power loading 10.5 lb./h.p. (4.76 kg./h.p.).

Weights and Loadings (C-119G).—
- Weight empty 39,982 lb. (18,152 kg.).
- Payload 28,000 lb. (12,712 kg.).
- Max. T.O. weight 74,400 lb. (33,778 kg.).
- Wing loading 51.4 lb./sq. ft. (250.8 kg./m.^{2}).
- Power loading 10.6 lb./h.p. (4.81 kg./h.p.).



The Fairchild C-123B Military Transport (two 2,500 h.p. Pratt & Whitney R-2800 engines). (*Gordon Williams*).



The Fairchild C-123B fitted experimentally with two wing-tip-mounted Fairchild J44 turbojet engines.

PERFORMANCE (C-119C—2 × Pratt & Whitney R-4360-20W engines).—
Cruising speed at 70% normal rated power 200 m.p.h. (320 km.h.).
Stalling speed 108 m.p.h. (173 km.h.).
Rate of climb at S/L. 740 ft./min. (226 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max. standard fuel) 1,950 miles (3,120 km.).

PERFORMANCE (C-119F—2 × Wright R-3350-85 engines).—
Cruising speed at 70% normal rated power 205 m.p.h. (328 km.h.).
Stalling speed 108 m.p.h. (173 km.h.).
Rate of climb at S/L. 820 ft./min. (250 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max. standard fuel) 2,300 miles (3,680 km.).

PERFORMANCE (C-119G—2 × Wright R-3350-85 engines).—
Cruising speed at 70% normal rated power 200 m.p.h. (320 km.h.).
Stalling speed 108 m.p.h. (173 km.h.).
Rate of climb at S/L. 750 ft./min. (230 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max. standard fuel) 2,280 miles (3,648 km.).

THE FAIRCHILD C-123B.

The C-123 was designed by the original Chase Aircraft Company, Inc. A production order for 300 C-123B's held by the Kaiser-Frazer Corporation, which had acquired a majority interest in the Chase company in 1953, was cancelled in June of that year. New bids were asked for, as the result of which production of the C-123B was assigned to Fairchild. The first Fairchild-built C-123B flew for the first time on September 1, 1954.

The prototype C-123B has been fitted experimentally with two Fairchild J44 turbojet engines (1,000 lb.=454 kg. s.t. each) mounted at the wing-tips to provide auxiliary power for use in emergency, particularly in the event of failure of one engine on take-off. In tests the C-123B, loaded to its gross all-up weight and with one engine feathered during take-off, showed an increase in rate of climb of from 150 ft./min. to 500 ft./min. with the jet augmenters in operation. The jet-augmented C-123B, which is a private research project, first flew on February 7, 1955.

TYPE.—Twin-engined Troop and Cargo-carrying Transport for operation from short or unprepared landing fields.

WINGS.—High-wing cantilever monoplane. Aspect ratio 9.89. All metal structure. Flaps inboard of ailerons and divided by tail cones of engine nacelles. Aileron area 83.28 sq. ft. (7.73 m.²), flap area 128.00 sq. ft. (11.89 m.²), gross wing area 1,223.22 sq. ft. (113.64 m.²).

FUSELAGE.—The main fuselage frame is of stressed-skin monocoque construction. The nose is of truss-type welded steel tubing to provide maximum crash protection for flight personnel.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with fabric-covered control surfaces. Trim-tabs in elevators and rudder. Total horizontal tail area 337.4 sq. ft. (31.34 m.²), fin area 314.17 sq. ft. (29.18 m.²), elevator area 119.77 sq. ft. (11.13 m.²), rudder area 59.19 sq. ft. (5.59 m.²).

LANDING GEAR.—Retractable tricycle type. Main gear retracts up into fuselage and is completely enclosed when retracted. A high-strength drag link is incorporated to carry drag loads and side loads from the gear to increase the utility of the aircraft for rough field operation. The dual wheel nose wheel unit is also completely retractable. Main wheels have low-pressure tyres and Westinghouse Decelostat anti-skid braking equipment. Track 12 ft. 1 in. (3.69 m.).

POWER PLANT.—Two 2,500 h.p. Pratt & Whitney R-2800-99W radial air-cooled engines driving Hamilton Standard three-blade steel constant-speed feathering and reversing airscrews. Jettisonable self-sealing fuel tanks installed in nacelles. The power-plant installation is such that a complete engine change forward of the fire-wall, may be made in 45 minutes. Quick disconnect fittings are provided in all lines and mechanisms to facilitate the operation.

ACCOMMODATION.—Flight compartment in nose, seats crew of two. Cargo compartment 36 ft. 8 in. (11.18 m.) long, 9 ft. 2 in. (2.79 m.) wide and 8 ft. 2 in. (2.48 m.) high with a usable floor area of 450 sq. ft. (41.8 m.²) and cubic capacity of 3,570 cub. ft. (100 m.³). The compartment floor is stressed to support distributed loads of 250 lb./sq. ft. (1,220 kg./m.²) and two treadways accommodate vehicles with loadings up to 6,500 lb. (3,405 kg.) per wheel. Tie-down fittings are spaced over a total floor area on a 20 in. (50.8 cm.) grid pattern, each fitting capable of sustaining a 10,000 lb. (4,535 kg.) load in any direction. The large rear loading door is formed by lowering the rear sloping wall of the hold to form a ramp and an upper door which folds inside fuselage to give adequate clearance for vehicles, bulky freight, etc. Ramp is hydraulically operated. Compartment can receive a 155 mm. howitzer and one truck or any comparable combination of wheeled units. As a personnel carrier, plane can accommodate 60 fully-equipped troops, 50 stretcher patients, plus 6 sitting patients and 6 medical attendants. Personnel can enter by side doors which may also be used for parachute jumping.

DIMENSIONS.—
Span 110 ft. (33.55 m.).
Length 75 ft. 9 in. (23.10 m.).
Height 34 ft. 1 in. (10.38 m.).

WEIGHTS AND LOADINGS.—
Weight empty 31,058 lb. (14,100 kg.).
Max. gross weight 60,000 lb. (27,240 kg.).
Wing loading 49.0 lb./sq. ft. (239.12 kg./m.²).
Power loading at max. A.U.W. 12.0 lb./h.p. (5.44 kg./h.p.).

PERFORMANCE.—
Max. speed 245 m.p.h. (392 km.h.).
Cruising speed (at 61% power) 190 m.p.h. (304 km.h.).
Stalling speed 75 m.p.h. (120 km.h.).
Rate of climb 1,150 ft./min. (350 m./min.).
Service ceiling 23,000 ft. (7,015 m.).
Range with max. cargo and optimum cruising speed at 5,000 ft. (1,525 m.) 1,470 miles (2,350 km.).

FLETCHER

FLETCHER AVIATION CORPORATION.

HEAD OFFICE AND WORKS: FLETCHER AIRPORT, ROSEMEAD, CALIFORNIA.

President: Wendell S. Fletcher.

Assistant to the President: Major-General Leroy H. Watson, U.S. Army (Retd.).

Executive Vice-President: Leland C. Launer.

Treasurer: D. V. Nelson.

Secretary: Maurice C. Fletcher.

Assistant Secretary: H. E. Fletcher.

The Fletcher Aviation Corpn. entered the aircraft manufacturing field in 1941 with a two-seat primary trainer employing a plastic-plywood construction and incorporating symmetrical wings and control surfaces to provide complete interchangeability of wings, flaps, ailerons and tail-surfaces. This aircraft, the FBT-2, has been described in previous issues of this Annual.

During the war the Fletcher Aviation Corpn. was almost exclusively engaged in the manufacture of plastic plywood aircraft, components, parts and assemblies.

The Company's first post-war aircraft was the FL-23 all-metal two-seat military liaison monoplane, and this has now been followed by the FD-25, the latest version of which, the FD-25-B, is described and illustrated hereafter.

A licence for the construction of the FD-25-B has been acquired by the Toyo Aircraft Company of Tokyo, Japan.

The latest product of the company is the FU-24 general utility monoplane, details of which follow.

The Fletcher Aviation Corporation has established itself as the foremost producer of jettisonable fuel tanks in America. Over 200,000 fuel and napalm tanks have been produced and delivered to the U.S. Air Forces under prime contracts.

THE FLETCHER FU-24.

TYPE.—Single-seat General Utility monoplane developed primarily for agricultural uses.

WINGS.—Low-wing cantilever monoplane. NACA 4415 wing section. Aspect ratio 6. Chord 7 ft. (2.13 m.). Dihedral (outer wings) 8°. Incidence +2°. All-metal two-spar double-celled structure. All-metal slotted flaps. All-metal plain ailerons on outer wings. Total flap area 17.0 sq. ft. (1.58 m.²). Total aileron area 9.3 sq. ft. (0.86 m.²). Gross wing area 294 sq. ft. (27.31 m.²).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever all-metal structure. All-movable horizontal tail with servo-tab control. Areas: fin 12.0 sq. ft. (1.11 m.²), rudder 12.5 sq. ft. (1.16 m.²), horizontal tail 43.1 sq. ft. (4.00 m.²), servo tab 4.9 sq. ft. (0.45 m.²).

LANDING GEAR.—Fixed nose-wheel type. Fletcher air-oil shock-absorber struts. Goodrich wheels and tyres. Goodrich hydraulic expander tube brakes on main wheels. Track 12 ft. 2 in. (3.71 m.). Wheelbase 7 ft. 6 in. (2.28 m.).

POWER PLANT.—One 225 h.p. Continental O-470-A six-cylinder horizontally-opposed air-cooled engine. Hartzell two-blade metal airscrew. Two fuel tanks (24 U.S. gallons each) one in each wing.

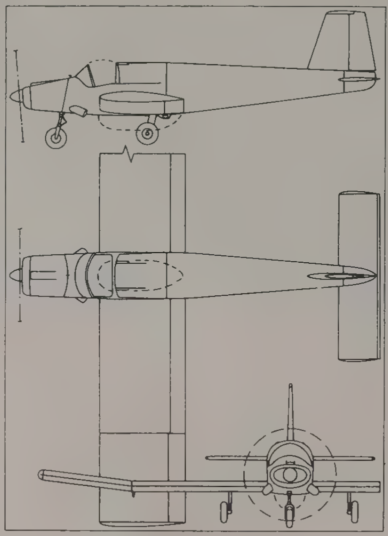
ACCOMMODATION.—Open cockpit over leading-edge of wings.

DIMENSIONS.—
Span 42 ft. (12.81 m.).
Length 31 ft. 10 in. (9.69 m.).
Height 10 ft. 4 in. (3.14 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,909 lb. (867 kg.).
Pilot 170 lb. (77 kg.).
Fuel (20 U.S. gallons) and oil 143 lb. (65 kg.).
Payload 1,250 lb. (567 kg.).
Total disposable load 1,563 lb. (709 kg.).
Weight loaded 3,472 lb. (1,576 kg.).
Wing loading 11.9 lb./sq. ft. (58.07 kg./m.²).
Power loading 15.5 lb./h.p. (7.03 kg./h.p.).

PERFORMANCE at 3,500 lb.=1,590 kg. A.U.W.).—
Max. speed at S/L. 135 m.p.h. (216 km.h.).
Cruising speed 117 m.p.h. (187 km.h.).
Min. speed (flaps up, power off) 56 m.p.h. (89.6 km.h.).
Min. speed (flaps down, power off) 44 m.p.h. (70.4 km.h.).
Min. speed (flaps down, power on) 42 m.p.h. (67.2 km.h.).
Rate of climb at S/L. 750 ft./min. (229 m./min.).
Service ceiling 15,700 ft. (4,790 m.).
Cruising range (40 U.S. gallons) 370 miles (592 km.).
Cruising endurance (40 U.S. gallons) 3.4 hours.
Take-off to clear 50 ft. (15.25 m.), off grass 870 ft. (265 m.).
Take-off speed 50 m.p.h. (80 km.h.).

The Fletcher FU-24 (225 h.p. Continental O-470 engine).



The Fletcher FU-24.

The Fletcher FU-24 (225 h.p. Continental O-470 engine).

THE FLETCHER FD-25-B DEFENDER.

TYPE.—Single-seat Light Ground Support aircraft.

WINGS.—Low-wing cantilever monoplane. Wing section. NACA 65.5-415. Aspect ratio 6. Chord 5 ft. (1.52 m.). Dihedral (outer wings) 6°. All-metal structure with main spar and auxiliary spar for attachment of flaps and ailerons. All-metal ailerons on outer wings, interchangeable right and left. All-metal flaps. Total flap area 18 sq. ft. (1.67 m.²). Gross wing area 150 sq. ft. (13.93 m.²).

FUSELAGE.—All-metal aluminium-alloy semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal aluminium-alloy structure. Areas: fin 8 sq. ft. (0.74 m.²), rudder 4 sq. ft. (0.37 m.²), elevator 9 sq. ft. (0.84 m.²), tailplane 21 sq. ft. (1.95 m.²).

LANDING GEAR.—Fixed tail-wheel type. Cantilever oleo-pneumatic shock absorber legs. Hydraulic wheel brakes. Steel-sprung steerable tail-wheel. Track 8 ft. 1 in. (2.45 m.).

POWER PLANT.—One 225 h.p. Continental E225-8 six-cylinder horizontally-opposed air-cooled engine with Fletcher exhaust augmenters. Hartzell HC-12-20 two-blade controllable-pitch airscrew. Fuel capacity 60 U.S. gallons (227 litres). Oil capacity 2.25 U.S. gallons (8.5 litres).

ACCOMMODATION.—Single-seat cockpit with acrylate plastic sliding canopy. Forward vision over nose 11°. Seat has adjustable back to allow for back-type parachute. Shoulder harness and inertia lock reel.

ARMAMENT.—Two-wing mounted 30-cal. machine-guns (1,000 r.p.g.). Provision for the following under-wing stores: 2×40 U.S. gallon (151 litres) Napalm bombs; 2×250 lb. (113.5 kg.) H.E. or fragmentation bombs; 32 or 40×2.75 in. rockets in clusters; 4 × 5 in. rockets; or 20 × 8 cm. rockets.

DIMENSIONS.—
Span 30 ft. (9.15 m.).
Length 20 ft. 11 in. (6.38 m.).
Height 6 ft. 3 in. (1.90 m.).

WEIGHTS.—
Weight empty 1,228 lb. (558 kg.).
Weight loaded 2,500 lb. (1,135 kg.).

PERFORMANCE.—
Max. speed at S/L. 187 m.p.h. (299 km.h.).
Cruising speed at S/L. 162 m.p.h. (259 km.h.).
Landing speed 45 m.p.h. (72 km.h.).
Initial rate of climb 1,725 ft./min. (526 m./min.).
Service ceiling 16,500 ft. (5,030 m.).
Cruising range 630 miles (1,010 km.).

FLYRIDE

GLENVIEW METAL PRODUCTS COMPANY.

HEAD OFFICE: DELANCO, NEW JERSEY.

AIRCRAFT DIVISION: RIVERSIDE, NEW JERSEY.

President: John T. Dooley.

Vice-President and Treasurer: John V. Haselbarth.

Chief Engineer: William E. Hunt.

Chief Pilot, Aircraft Division: Frank Horne.

The Glenview Metal Products Company, specialists in precision machining and sub-assembly of component parts for the aircraft industry and of a wide variety of other industrial products, has established an aircraft division to manufacture and market the "Flyride" helicopter.

The principal novelty of the "Flyride" helicopter is a greatly simplified control system, which consists only of two primary units, a stick with a motorcycle twist grip and the throttle. The stick, only 6 inches high and housed in the arm-rest between the two seats, governs all manoeuvring in horizontal flight while the throttle controls the ascent and descent.

The first prototype, which had 51 hours air time prior to a change in power-plant, is being used for CAA ground testing. Many hours of test flying have been logged with a second prototype, during which period several modifications to both the tail structure and control system have been successfully carried out. At the time of writing a weight-reducing programme was under way, after which CAA certification will be completed.

THE GMP-2 "FLYRIDE" HELICOPTER.

TYPE.—Two-seat civil Helicopter.

ROTOR SYSTEM.—Two-blade main rotor and two-blade anti-torque rotor. Main rotor blades of solid laminated spruce to 30% of chord, aft of which laminated low-density balsa wood is used the whole being covered with Fiberglas cloth. Stainless steel leading-edge abrasion strip cyclo-welded on. Blades are hinged for flapping movement only. Tail rotor blades of solid laminated spruce covered with Fiberglas. Main rotor driven through a transmission system situated aft of seats and comprising a first-stage helical spur gear train driving a right-angle spiral bevel pinion and gear. Chord of main blades from 1 ft. to 12 ft. (0.304 m. to 3.658 m.)

radii 14.2 in. (36.07 cm.), chord at tip 10.9 in. (27.69 cm.). Main rotor blade area 31.8 sq. ft. (2.95 m.^{2}). Main rotor disc area 731 sq. ft. (67.91 m.^{2}). Gear ratio engine/main rotor 9.586 : 1. Anti-torque rotor diameter 5 ft. 2½ in. (1.588 m.). Anti-torque rotor blade area 2 sq. ft. (0.18 m.^{2}). Anti-torque rotor disc area 13.7 sq. ft. (1.27 m.^{2}). Gear ratio engine/anti-torque rotor 1 : 0.928.

Fuselage.—All-metal semi-monocoque structure.

Landing Gear.—Fixed tricycle type. Track (main wheels) 7 ft. (2.13 m.).

Power Plant.—One 140 h.p. Lycoming O-290-D2 engine mounted in nose of fuselage and accessible by removal of non-structural hinged cover. A centrifugal clutch and over-running mechanism is located on the normal propeller flange which in turn drives a shaft connected to the main rotor transmission. This shaft passes between the two seats inside a tunnel which serves both as a structural member and as an arm-rest. Engine cooled by a 24-blade axial-flow fan which also acts as a flywheel. Fuel tank (20 U.S. gallons = 76 litres capacity) is located above and to rear of main landing wheels and is of Goodyear Pliocele bladder type.

Accommodation.—Enclosed cabin seating two side-by-side. Single control stick in arm-rest between seats.

Dimensions.—
Length of fuselage 24 ft. 5 in. (7.44 m.).
Overall length (blade tip to tail) 35 ft. 7 in. (10.84 m.).
Height (blades in neutral position) 8 ft. 8½ in. (2.65 m.).

The GMP-2 "Flyride" Helicopter (140 h.p. Lycoming O-290 engine).

Weights and Loadings (Designed).—
Weight empty 1,150 lb. (522 kg.).
Weight loaded (two passengers, baggage, fuel and oil) 1,655 lb. (751 kg.).
Disc loading 2.26 lb./sq. ft. (11.034 kg./m.^{2}).
Power loading 12.8 lb./h.p. (5.8 kg./h.p.).

Performance (Estimated).—
Cruising speed (75% power) 95 m.p.h. (152 km.h.).
Rate of climb 1,200 ft./min. (366 m./min.).
Service ceiling 15,000 ft. (4,572 m.).
Hovering ceiling 4,200 ft. (1,280 m.).
Cruising range 230 miles (370 km.).

GOODYEAR

THE GOODYEAR AIRCRAFT CORPORATION.

Head Office and Works: Akron 15, Ohio.

The Goodyear Aircraft Corporation, known primarily as a builder of airships, although the company did manufacture complete aircraft during the last war and is still engaged in important sub-contract work for other aircraft manufacturers, has now entered the light helicopter field.

The first Goodyear helicopter, the "Project 400" or Model GA-400R, was designed by the Goodyear Aircraft Corporation, built by the Goodyear Tire and Rubber Company subsidiary and was flown for the first time at the company's airport at Wingfoot Lake, Akron, Ohio, on May 9, 1954.

THE GOODYEAR GA-400R.

The GA-400R, a one-man ultra-light helicopter, was designed to serve either as a courier-liaison or a tactical vehicle. It has no military designation but has been demonstrated for various U.S. military agencies.

The airframe of welded steel tubing is supported by steel outrigger tubes and parallel aluminium tubular skids. Power is supplied by a production water-cooled two-stroke engine which drives the main and anti-torque rotors through a belt and pulley arrangement. The craft has a gross weight of more than 400 lb. (181.6 kg.).

The Goodyear GA-400R Light Single-seat Helicopter.

The GA-400R helicopter is still in the experimental stage and at the time of writing no structural details or specification has been disclosed.

GRUMMAN

THE GRUMMAN AIRCRAFT ENGINEERING CORPORATION.

Head Office and Works: Bethpage, Long Island, N.Y.

Incorporated: December 6, 1929.

Chairman of the Board: Leroy R. Grumman.

President: Leon A. Swirbul.

Executive Vice-President: William T. Schwendler.

Administrative Vice-President: E. Clinton Towl.

Vice-President, Engineering: Robert L. Hall.

Vice-President, Manufacturing Engineering: William J. Hoffman.

Vice-President, Production: David Rittenhouse.

Vice-President, Contracts: George F. Titterton.

Vice-President and General Counsel: Charles Kingsley.

Secretary: Joseph A. Stamm.

Treasurer: Edmund W. Poor.

The Grumman Aircraft Engineering Corpn. continues to devote its principal activities to the construction and experimental development of aircraft for the U.S. Navy.

The latest Grumman naval fighters of which details have been released are the supersonic F11F-1 Tiger light fighter and the swept-wing F9F-8 Cougar, which replaced the F9F-6 and F9F-7 in production in 1954.

The AF-2 Guardian single-engined anti-submarine aircraft was phased out of production in March, 1953, and its successor, the S2F-1 twin-engined Search aircraft is now in production.

The Albatross is still being delivered in small numbers to the U.S.A.F., U.S. Navy and U.S. Coast Guard as an amphibian. It is no longer being produced as a triphibian.

THE GRUMMAN G-98 TIGER.

U.S. Navy designation: F11F.

Although it originally carried the basic F9F designation of the Cougar and Panther, the Tiger, which is a completely new design, has now been given the designation F11F. Originally conceived as an improved Cougar, the Tiger was designed with a view to providing a substantial increase in performance while keeping the aircraft small and light.

The Tiger, which is capable of supersonic speeds in level flight, incorporates a number of design refinements which permit a reduction of weight and size without detracting from its service suitability. The most interesting design

The Grumman F11F-1 Tiger Naval Fighter (Wright J65 turbojet engine).

feature is the slight "waisting" of the fuselage amidships in the region where the wing joins the fuselage. This design feature, known as "area control," is claimed to ensure optimum drag characteristics at sonic speeds.

The first of six prototype Tigers flew on July 30, 1954, less than fifteen months after the receipt of the Letter of Intent from the Navy Bureau of Aeronautics. The F11F-1 is now in production.

TYPE.—Single-seat Naval Carrier Fighter.

WINGS.—Cantilever mid-wing monoplane. 30° leading-edge sweepback. 6.5% thickness/chord ratio. All-metal structure. One-piece machined upper and lower skins. Leading-edge slats. Trailing-edge flaps over whole of fixed portion of wings, the wing-tips being manually hinged for carrier stowage. Lateral control by spoilers plus small ailerons on wing-tip sections.

FUSELAGE.—All-metal structure. Finger-type air brakes on underside of fuselage in line with trailing-edge of wings.

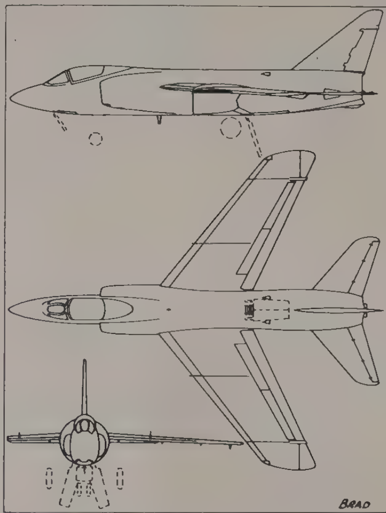
TAIL UNIT.—All surfaces swept. Comprises fixed fin, rudder and low-mounted all-flying tailplane with slight dihedral.

LANDING GEAR.—Retractable tricycle type. All wheels retract into fuselage.

POWER PLANT.—One Wright J65-W-6 axial-flow turbojet engine (7,800 lb.=3,540 kg. s.t.) with afterburner.

ACCOMMODATION.—Pressurised cockpit in nose. Ejector seat.

ARMAMENT.—Four 20 mm. cannon. Provision for air-to-air and air-to-ground missiles.



The Grumman F11F-1 Tiger.

DIMENSIONS.—
Span 31 ft. 8 in. (9.65 m.).
Length 40 ft. 10 in. (12.44 m.).
Height 12 ft. 9 in. (3.88 m.).

WEIGHTS.—
Normal loaded weight 13,850 lb. (6,290 kg.).

PERFORMANCE.—No data available.

THE GRUMMAN G-93 COUGAR.

U.S. Navy designation: F9F.

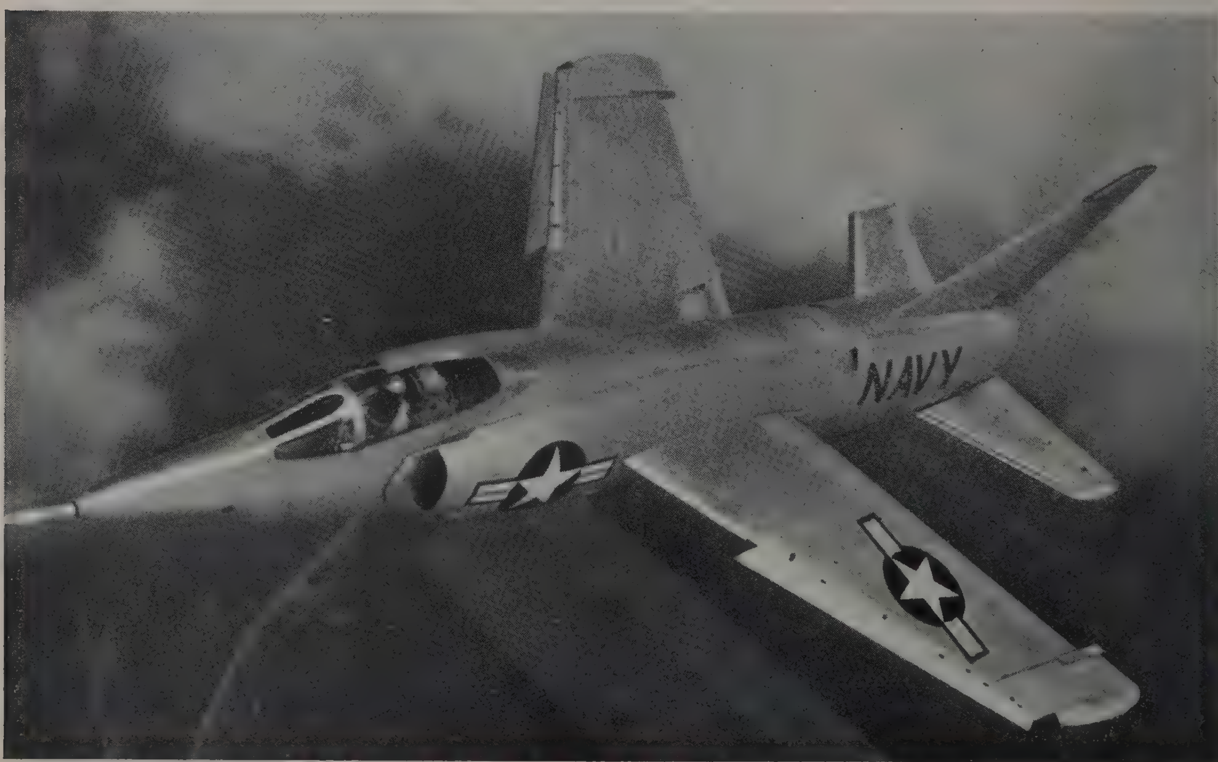
The Cougar is a swept-wing development of the F9F Panther. The fuselage is similar to that of the Panther, but new 35° swept wings and tailplane are incorporated. Spoilers replace the ailerons for lateral control.

Three versions of the Cougar have been produced :—

F9F-6. One Pratt & Whitney J48-P-8 (7,250 lb.=3,290 kg. s.t.). Prototype first flew on September 20, 1951. Armament consists of four 20 mm. cannon. F9F-6P is photographic reconnaissance aircraft with longer nose to accommodate K-17 and trimetrogon cameras. Cannon armament eliminated.

F9F-7. One Allison J33-A-16A (6,350 lb.=2,880 kg. s.t.). Same as F9F-6 except for power-plant.

F9F-8. One Pratt & Whitney J48-P-8 engine. Development of F9F-6 with greater speed and range. Movable leading-edge slats replaced by fixed cambered leading-edge extensions outboard of fences and trailing-edge extended. Elimination of hydraulic system necessary to operate wing slats provides space for 30 additional U.S. gallons of fuel in each wing. Centre fuselage lengthened by 8 inches to make room for additional 80 U.S. gallons in front, or main, fuselage tank. Total internal fuel load increased by 140 U.S.



The Grumman F11F-1 Tiger Naval Fighter (Wright J65 turbojet engine).

The Grumman F9F-8 Cougar Naval Fighter (Pratt & Whitney J48 turbojet engine). (*Harold Martin*).

gallons. First production F9F-8 flew for first time on January 18, 1954.

TYPE.—Single-seat Naval Carrier Fighter.

WINGS.—Low-wing cantilever swept-wing monoplane. Outboard of air inlets wings have 35° L/E. sweepback. Structure similar to that of Panther. Trailing-edge flap over ¾ span. Lateral control by hydraulically-operated span-wise spoilers on upper surface of wings at 75% of chord line. Artificial feel system incorporated in lateral control. Electrically operated trim-tab near port wing-tip. Auto-slats on F9F-6 and -7, fixed cambered leading-edge extensions on F9F-8. Wing fences on all models.

FUSELAGE.—Similar to F9F Panther.

TAIL UNIT.—Similar to F9F Panther but with backswept horizontal surfaces. Hydraulically adjustable tailplane linked with flap control to provide constant longitudinal trim during flap movement. Electrically-operated trim-tab in rudder.

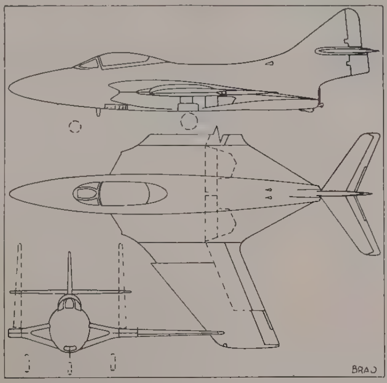
LANDING GEAR.—Similar to F9F Panther.

POWER PLANT.—One Pratt & Whitney J48 or Allison J33 turbojet engine. Installation as in F9F Panther. Two self-sealing fuel tanks in fuselage and two non-sealing bladder tanks in wings. Increased fuel capacity in fuselage and wings in F9F-8. All tanks pressurised and all fuel can be jettisoned from wing-tip outlets by ram pressure. Provision for two 150 U.S. gallon drop tanks to be carried on underwing bomb shackles.

ACCOMMODATION.—Similar to that of F9F Panther.

ARMAMENT.—Four nose-mounted 20 mm. cannon. Under wing racks for either two 1,000 lb. bombs or six HVAR rockets.

DIMENSIONS.—
Span 34 ft. 6 in. (10.52 m.).



The Grumman F9F-8 Cougar.

Length (F9F-6 and -7) 40 ft. 2 in. (12.24 m.).
Length (F9F-6P) 41 ft. 2 in. (12.55 m.).
Length (F9F-8) 41 ft. 7 in. (12.68 m.).
Height 12 ft. 3 in. (3.73 m.).

WEIGHTS.—
Normal loaded weight about 20,000 lb. (9,080 kg.).

PERFORMANCE.—
Max. speed (F9F-6 and -7) 690 m.p.h. (1,104 km.h.).
Max. speed (F9F-8) 712 miles m.p.h. (1,139 km.h.).

THE GRUMMAN G-79 PANTHER.
U.S. Navy designation : F9F.

The original layout of this aircraft provided for the installation of four wing-mounted Westinghouse 19XB-2B (J30-WE-20) axial-flow jets, but this arrangement was abandoned in favour of one fuselage-mounted high-powered jet engine before the prototype construction began, a change prompted by the successful tests conducted by the U.S. Navy at the Naval Air Materiel Center, Philadelphia, in December, 1946, with two imported Rolls-Royce Nene engines.

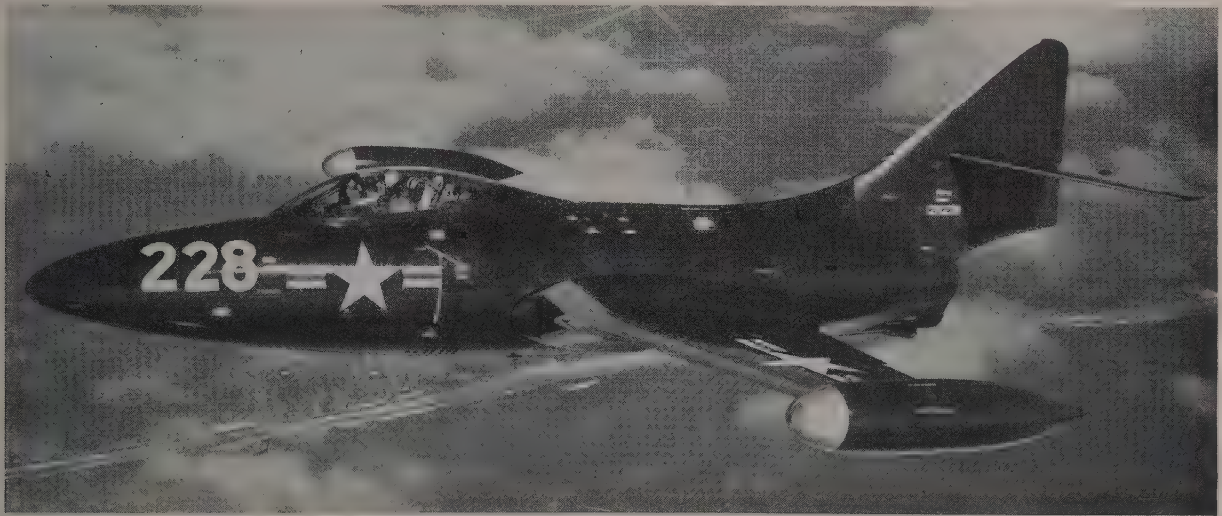
The first prototype XF9F-2 was powered with an imported Rolls-Royce Nene engine. The third prototype was similarly fitted, but the second, the XF9F-3, had the Allison J33 engine.

F9F-2. One Pratt & Whitney J42-P-6 (5,000 lb.=2,270 kg. s.t.). Two prototypes (XF9F-2) built, the first flying for first time on November 24, 1947. First production F9F-2 flew on November 24, 1948. 437 delivered to U.S. Navy and Marine Corps.

F9F-3. One Allison J33-A-8 (4,600 lb.=2,090 kg. s.t. dry). Prototype flew on August 15, 1948. 54 ordered but all later converted to F9F-2 standard.

F9F-4. One Allison J33-A-16A (6,350 lb.=2,880 kg. s.t. dry). Original contract for 73, but this and subsequent contracts combined with F9F-5.

F9F-5. One Pratt & Whitney J48-P-4 (6,250 lb.=2,840 kg. s.t. dry) or (later) J48-P-8 (7,250 lb.=3,290 kg. s.t. dry). Redesigned with larger fuselage and higher tail. The prototype, a modified F9F-2, first flew on December 21, 1949. 640 delivered to U.S. Navy and Marine



The Grumman F9F-5 Panther Naval Fighter (Pratt & Whitney J48 turbojet engine). (*Harold Martin*).

The Grumman F9F-5P Panther Photographic Reconnaissance Monoplane with under-wing long-range tanks. (*Harold Martin*).

Corps. F9F-5P is long-range photographic reconnaissance version with longer camera nose and provision for two 150 U.S. gallon underwing drop tanks on bomb shackles.

TYPE.—Single-seat Naval Carrier Fighter.

WINGS.—Low-wing cantilever monoplane. All-metal structure with flush-riveted stressed skin. Trailing-edge flaps inboard of ailerons and beneath fuselage. Variable-camber leading-edge flaps inter-connected with trailing-edge flaps. Hydraulic-operation. Upward-folding wings for carrier stowage.

FUSELAGE.—All-metal structure with flush-riveted stressed skin. Quickly detachable nose for servicing equipment and for interchangeability of armament, photographic and electronic equipment. Tail section quickly removable for access to engine compartment.

TAIL UNIT.—Cantilever monoplane type. Fin integral with fuselage. Tailplane mounted halfway up fin. All-metal structure.

LANDING GEAR.—Retractable tricycle type. Main wheels raised inwardly into thickened wing roots, nose wheel backwards into fuselage. Hydraulic retraction. Retractable arrester hook in rear end of fuselage below jet outlet.

POWER PLANT.—One Pratt & Whitney J42 or J48 or Allison J33 turbojet in plenum chamber amidships with air inlets in thickened wing-roots and jet exit beneath rear end of fuselage. Four spring-loaded blower doors in sides of plenum chamber may be opened to induce accelerated air-flow through chamber at low flying speeds at take-off and landing to eliminate stalling of air at lower lip of duct intakes at coarse angles of attack. Two additional doors aft release ram pressure in plenum chamber in the event of pressure seal failure. Fuel in internal and wing-tip tanks. Latter are permanent to ensure cleaner fit and to get over difficulty of jettisoning both tanks simultaneously. Fuel can be jettisoned in emergency by ram air valved into front of tanks. Probe-drogue in-flight refuelling equipment.

ACCOMMODATION.—Pilot's pressurised cockpit forward of wings with sliding and jettisonable canopy. Heating and refrigeration, pilot's ejector seat.

ARMAMENT.—Four 20 mm. nose-mounted cannon. May also carry external stores in the form of 5 in. rockets, 500 lb. bombs, Napalm bombs, etc.

DIMENSIONS (F9F-2 and -3).—
Span 38 ft. (11.6 m.).
Length 40 ft. (12.2 m.).
Height (over tail) 15 ft. (4.5 m.).

DIMENSIONS (F9F-4 and -5).—
Span 38 ft. (11.6 m.).
Length 42 ft. (12.8 m.).
Height 16 ft. (4.8 m.).

WEIGHTS.—
Weight empty 8,660 lb. (3,930 kg.).
Weight loaded 17,000 lb. (7,720 kg.).

PERFORMANCE (F9F-5).—
Max. speed about 625 m.p.h. (1,000 km.h.).
Initial rate of climb approx. 9,000 ft./min. (2,745 m./min.).
Service ceiling over 50,000 ft. (15,250 m.).

THE GRUMMAN G-89.

U.S. Navy designation : S2F.

The S2F is a twin-engined carrier-based Anti-Submarine search and attack aircraft which is in production for the U.S. Navy. The prototype X2SF-1 made its first flight on December 4, 1952.

The S2F is a high-wing monoplane which is powered by two Wright R-1820 engines. The tricycle landing-gear has a dual-wheel nose-wheel unit and there is a small wheel-bumper aft which is extendable but not fully retractable. A split rudder has been developed for the S2F to assist single-engine performance.

There is a retractable radome under the rear fuselage behind a large bomb-bay, and the engine nacelles are used for the stowage of expendable submarine-detection equipment.

The following versions of the S2F have been mentioned :—

S2F-1. Two 1,525 h.p. Wright R-1820-82 engines. First production model.

S2F-2. Developed version of S2F-1 with larger bomb-bay and other internal changes.

CS2F-1. Canadian production version of S2F-1 to be built under licence for Royal Canadian Navy by de Havilland Aircraft of Canada, Ltd. To be powered by two 1,525 h.p. Wright R-1820-82 engines and Hamilton Standard airscrews

The Grumman S2F-1 Anti-submarine Monoplane (two Wright R-1820 engines). (*Harold Martin*).

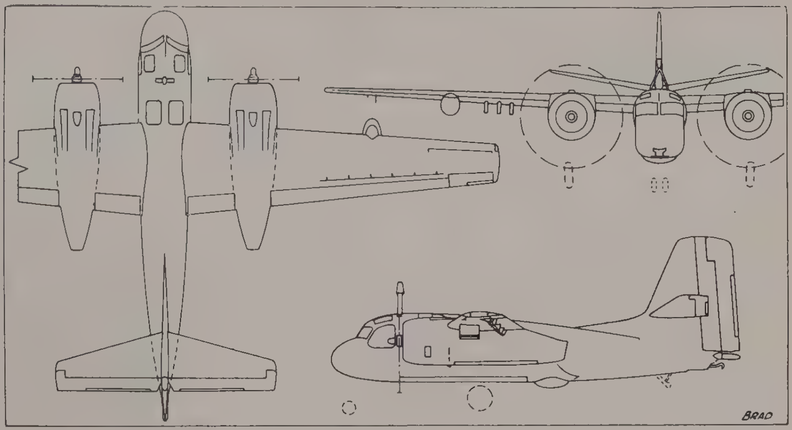
The Grumman S2F-1 Anti-submarine Monoplane with wings folded. (*Gordon Williams*).

built by Canadian Pratt & Whitney Aircraft Co., Ltd.

No other details of this aircraft had been released for publication up to the time of going to press.

DIMENSIONS.—
Span 69 ft. 8 in. (21.24 m.).
Length 42 ft. 3 in. (12.88 m.).
Height 16 ft. 3⅛ in. (4.96 m.).
Span of tail 22 ft. 5 in. (6.84 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The Grumman S2F-1.

THE GRUMMAN G-82 GUARDIAN.

U.S. Navy designation: AF.

The following versions of the Guardian are in service :—

AF-2W. Search version. Large search and early warning radome beneath forward fuselage.

AF-2S. Attack version. Internal stowage for various offensive stores, which may include one 2,000 lb. (908 kg.) torpedo, or two 1,600 lb. (726 kg.) depth charges, or two 2,000 lb. (908 kg.) bombs. Any of these stores can be duplicated and carried externally beneath wings. Searchlight under port wing and radar scanner under starboard wing, both in identically-shaped casings.

AF-3S. Similar to AF-2S but with additional submarine detection gear.

The Guardian went out of production in March, 1953.

TYPE.—Single-engined multi-seat Anti-submarine Monoplane in two versions, Search (AF-2W) and Attack (AF-2S) and AF-3S.

WINGS.—Mid-wing cantilever monoplane. Wing section NACA 23018 at root, NACA 23012 at tip. Aspect ratio 6.56. Taper ratio 2 : 1. Thickness ratio 1.6 : 1. All-metal structure. Outer wing sections fold back hydraulically about the centre-section rear spar hinges and when stowed lie parallel to fuselage with leading-edges downward. Slotted flaps between ailerons and fuselage. Spoiler flaps. Leading-edge slats ahead of ailerons. Gross wing area 560 sq. ft. (52 m.^{2}).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Auxiliary fin surfaces above and below tailplane.

LANDING GEAR.—Retractable type. Main wheels retract outwardly into outer wings. Dual tail-wheels non-retractable. Catapult points under wings. Sting-type arrester hook.

POWER PLANT.—One 2,400 h.p. Pratt & Whitney R-2800-48W fourteen-cylinder radial air-cooled engine driving a four-blade Hamilton Standard constant-speed

The Grumman AF-2S Guardian Anti-Submarine (Killer) Monoplane with wings folded. (*Harold Martin*).

The Grumman AF-2W Guardian Anti-Submarine (Hunter) Monoplane. (*Warren Bodie*).

airscrew 13 ft. 2 in. (4.01 m.) in diameter. Engine thrust-line at –3 degrees to datum.

ACCOMMODATION.—Crew of three, comprising pilot and two radar operators in AF-2W; or pilot, navigator/bomb-aimer and radar operator in AF-2S and AF-3S.

DIMENSIONS.—
Span 60 ft. 8 in. (18.5 m.).
Length 43 ft. 4 in. (13.2 m.).
Height 16 ft. 2 in. (4.93 m.).

WEIGHTS (Approx.).—
Weight empty 14,600 lb. (6,630 kg.).
Weight loaded 25,000 lb. (11,350 kg.).

PERFORMANCE (Approx.).—
Max. speed 315 m.p.h. (504 km.h.).
Stalling speed 83 m.p.h. (133 km.h.).
Range 1,500 miles (2,400 km.).

THE GRUMMAN G-64 ALBATROSS.

U.S. Air Force designation : SA-16A.
U.S. Navy and Coast Guard designation: UF-1.

The Albatross is now mainly in use in the U.S.A.F. (SA-16A) as an amphibian for Sea Rescue duties.

A limited number of Albatross general utility amphibians have also been supplied to the U.S. Navy and U.S. Coast Guard under the designation UF-1.

TYPE.—Twin-engined General Utility triphibian or amphibian flying-boat.

WINGS.—High-wing cantilever monoplane. All-metal structure. Wing in three sections a centre-section permanently attached to hull and two outer sections. Wing area 833 sq. ft. (77.5 m.^{2}).

HULL.—Two-step all-metal hull.

TAIL UNIT.—Cantilever monoplane type. Fin integral with hull. Tailplane span 29 ft. (8.84 m.).

LANDING GEAR.—Retractable nose-wheel type. Main wheels raised into sides of hull, twin nose wheels into nose of hull. Hydraulic retraction. Wheel track 17 ft. 8 in. (5.38 m.). Wheelbase 17 ft. 6 in. (5.34 m.).

POWER PLANT.—Two Wright R-1820-76A nine-cylinder radial air-cooled engines each with a normal rating of 1,275 h.p. from S.L. to 3,000 ft. (915 m.), 975 h.p. at 14,700 ft. (4,480 m.) and with 1,425 h.p. available for take-off. Three-blade Hamilton Standard constant-speed and reversing airscrews. Internal fuel in two tanks in centre-section outboard of hull with total capacity of 675 U.S. gallons (2,550 litres). Drop tanks of 100, 150 or 300 U.S. gallons (378, 567 or 1,135 litres) each may be carried on bomb-racks under centre-section, one on each side of hull. Each wing-tip float can carry a further 200 U.S. gallons (756 litres).

ACCOMMODATION.—Crew of four/six, pilot, co-pilot, navigator, radio/radar operator and, on special hospital missions, two medical attendants. Cabin may be adapted for various missions. As an ambulance 12 stretchers can be carried and for transport work 10 passengers in addition to crew of four. With seats removed cargo or special equipment can be accommodated. A "dutch-type" door is provided on port side for sea rescue operations or for loading stretchers. Door is split horizontally, the lower half being left in place to give higher freeboard in rough weather. A rescue platform may be attached to bottom door sill from which a crewman secured by safety belt may haul persons aboard from water. Smaller emergency door on starboard side. Both doors may be used for oblique photography and for handling sea anchor. Hatch in roof to facilitate loading of freight. Three life-rafts carried, two in cabin, and one of automatically inflatable type in compartment in top of hull aft of wing. Auxiliary power-plant in compartment aft of main cabin. Lavatory and tail compartment for stowing equipment and gear.

EQUIPMENT.—Racks under each wing can carry bombs, auxiliary fuel tanks, rescue boat or other packaged equipment. Radome on nose of hull. Provision for Jato units to be attached to cabin doors from inside of hull. Stowage for four Jato units below cabin floor between wheel wells. Stowage for two parachute flares in tail compartment. Separate oxygen supplied for crew and passengers with 20 outlets for oxygen masks in cabin.

DIMENSIONS.—
Span 80 ft. (24.4 m.).
Length 60 ft. 8 in. (18.5 m.).
Height 24 ft. 3 in. (7.3 m.).

WEIGHTS AND LOADINGS.—
Weight empty 20,100 lb. (9,125 kg.).
Weight loaded 27,025 lb. (12,270 kg.).
Wing loading 32.4 lb./sq. ft. (158.1 kg./m.^{2}).
Power loading 10.6 lb./h.p. (4.81 kg./h.p.).

PERFORMANCE.—
Max. speed at S.L. 247 m.p.h. (395 km.h.).
Max. speed at 18,800 ft. (5,735 m.) 264.5 m.p.h. (423 km.h.).
Cruising speed 225 m.p.h. (360 km.h.).
Stalling speed 79 m.p.h. (126.4 km.h.).
Initial rate of climb 1,400 ft./min. (427 m./min.).
Take-off distance at S.L. (no wind) 900 ft. (275 m.).
Take-off distance against 25 m.p.h. (40 km.h.) wind (off land) 330 ft. (100 m.).
Range (with 600 U.S. gallon=2,270 litres external fuel) 2,700 miles (4,320 km.).
Endurance (with 600 U.S. gallon=2,270 litres external fuel) 22.9 hours.

The Grumman UF-1 Albatross Amphibian (two 1,425 h.p. Wright R-1820 engines). (*Harold Martin*).

GYRODYNE

GYRODYNE COMPANY OF AMERICA, INC.

HEAD OFFICE AND WORKS: ST. JAMES, LONG ISLAND, N.Y.

Chairman: John A. Roosevelt.

President and Treasurer: Peter J. Papadakos.

Vice-Presidents: D. W. MacVicar and Rear Admiral James D. Barner (U.S.N. Ret.).

Comptroller: Joseph J. Dorn.

Secretary: Nicholas Xanthaky.

The Gyrodyne Company of America, Inc. (originally organised under the name P.C. Helicopter Corpn). was incorporated in New York State on August 7, 1946. The company was formed for the purpose of developing advanced types of rotary-wing aircraft.

The Gyrodyne Model 2C co-axial helicopter has successfully completed a comprehensive flight test programme under contract to the Departments of Defense. These tests served to demonstrate the performance, stability, and control characteristics of the Gyrodyne co-axial rotor system.

The Company is currently engaged on a contract from the U.S. Navy Bureau of Aeronautics to design, build and test a prototype of a one-man portable, co-axial "rotor-cycle" for the U.S. Marine Corps.

Commercial plans include the development of two helicopters utilising the Gyrodyne co-axial rotor system.

The Gyrodyne company is also actively engaged in sub-contract work for certain major aircraft companies.

The G.C.A. 2C Helicopter (450 h.p. Pratt & Whitney R-985 engine).

THE GYRODYNE XRON-1.

The XRON-1, which is under development for the U.S. Navy Bureau of Aeronautics, will be a one-man portable helicopter intended for use by the U.S. Marine Corps for "observation, liaison, escape and evasion and for small unit tactical manoeuvres."

The XRON-1 will be fitted with a 40 h.p. Nelson H-52 four-cylinder air-cooled two-stroke engine which will drive co-axial contra-rotating two-blade rotors.

The design calls for a craft which can be collapsed into a small package for easy transportation and can be quickly assembled in the field. Prime objectives of the design are extreme simplicity and adaptability to large-scale low-cost production.

No further details are available for publication.

HELIO

THE HELIO AIRCRAFT COMPANY.

HEAD OFFICE: NORWOOD METROPOLITAN AIRPORT, NORWOOD, MASS.

President and Chairman of the Board: Dr. L. L. Bollinger.

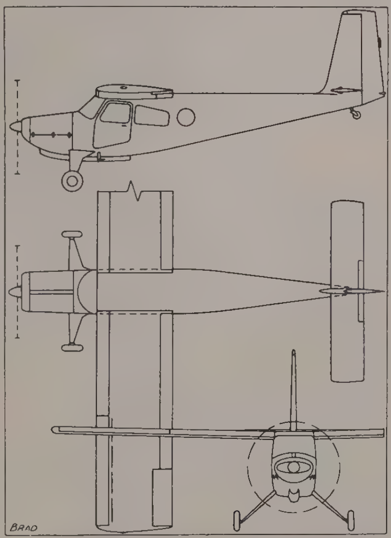
Vice-President: Dr. O. C. Koppen.

Manager and Chief Engineer: Lawrence N. Smithline.

The Helio Aircraft Company was formed by Dr. Otto C. Koppen of the Massachussetts Institute of Technology, and Dr. Lynn Bollinger, of the Harvard Graduate School of Business Administration, to develop a light aircraft of greater potential utility than any existing type. Quick take-off and climb, high cruising speed, fully-controllable flight at low speeds, freedom from stall and spin, low landing speed, low noise level, etc., were some of the qualities aimed at.

A Piper Vagabond was used as a basis for the construction of a prototype incorporating features designed to achieve the qualities mentioned above, but during modification the plane took on an entirely new configuration. Span was reduced by 9 in., the fuselage was lengthened by 45 in., an additional door was added, the rudder was re-designed, the landing-gear was moved forward and auto-slats were incorporated in the leading-edge of wings. To increase flap area, the ailerons were arranged to droop with the flaps when needed, the ailerons still being operated by the control column no matter what position they may be in. The rudder was split into two sections, the lower section being interconnected to the aileron control while the upper section was operated conventionally by pilot. To overcome the increased drag of flaps on take-off a 9-foot diameter Aeromatic airscrew with wide blades and constant-speed control was designed by the Koppers Company in collaboration with Dr. Koppen. A special silencer was designed and patented by Dr. Koppen for incorporation in the power-plant installation, and is located beneath the fuselage between the landing-gear struts. A Goodyear cross-wind landing-gear and oleo-pneumatic shock-absorbers were fitted.

The prototype, which was built by E. W. Wiggins, Norwood, Mass., first flew on April 8, 1949, and considerable test flying was conducted with this aircraft. On the basis of this experience the Helio Corporation designed a new four-seat aircraft known as the Helioplane-Four, which incorporated most of the features of the two-seat prototype.



The Helio H-391B Courier.

The Helio-Four was later re-designed to meet present-day requirements and to permit the use of a readily-available standard power-unit and airscrew.

In its new form the aircraft is known as the Helio Courier. It is now an all-metal cantilever high-wing monoplane, but retains the full-span automatic leading-edge slots and high-lift flap system of the earlier model, although the interconnection between the ailerons and lower portion of the rudder has been abandoned.

The Courier has been awarded C.A.A. Type Certificate 1A8 and is now being built by Mid-States Manufacturing Corporation, of Pittsburg, Kansas, under a production contract.

Fleet Manufacturing, Ltd. of Fort Erie, Ontario, Canada, is licenced to build the Courier in Canada and holds the sales rights for Canada and the British Commonwealth.

The Helio Aircraft Corporation retains all proprietary rights and is continuing engineering and design development at its plant in Norwood, Mass.

THE HELIO H-391B COURIER.

WINGS.—High-wing cantilever monoplane. NACA 23012 wing section. Aspect ratio 6. Dihedral 1½°. Incidence 3°. All-metal

The Helio H-391B Courier (260 h.p. Lycoming engine).

structure. Full-span automatic leading-edge-slats. NACA high-lift slotted all-metal flaps over 74% of span. Ailerons have duralumin frames and fabric covering. Gross wing area 231 sq. ft. (21.46 m.^{2}).

Fuselage.—All-metal structure. Cabin section has steel-tube framework, rear section is a monocoque.

Tail Unit.—Cantilever monoplane type. All-metal structure. There is no fixed tailplane. Span of tail 15 ft. (3.96 m.).

Landing Gear.—Fixed tail-wheel type. Cantilever struts with oleo-pneumatic springing. Goodyear cross-wind landing-gear optional. Goodyear brakes. Track 9 ft. (2.74 m.).

Power Plant.—One 260 h.p. Lycoming six-cylinder horizontally-opposed air-cooled geared engine. Ejector tube engine cooling. Hartzell 101 two-blade constant-speed airscrew. Two 30 U.S. gallon (113 litre) wing tanks.

Accommodation.—Cabin seats four in two pairs. Dual controls for front seats. CAA standard instrument panel Aerodynamically-positive (fully non-stallable) control system. Special over-strength cabin and seat structure based on Flight Safety Foundation recommendations. Two large doors at left front and right rear. Large baggage compartment (200 lb. = 91 kg. capacity) behind rear seats. If rear seats are removed a 6 ft. (1.83 m.) long cargo compartment is available for 1,000 lb. (454 kg.) industrial loads.

Dimensions.—
Span 39 ft. (11.89 m.).
Length 30 ft. (9.15 m.).
Height 8 ft. 10 in. (7.10 m.).

Weights and Loadings.—
Weight empty 1,900 lb. (861 kg.).
Weight loaded (normal category) 3,000 lb. (1,362 kg.).
Max. permissible loaded weight 3,500 lb. (1,590 kg.).
Wing loading 13 lb./sq. ft. (63.5 kg./m.^{2}).
Power loading 11.5 lb./h.p. (5.22 kg./h.p.).

Performance (at 2,800 lb. = 1,271 kg. A.U.W.).—
Cruising speed 157 m.p.h. (251 km.h.) at 8,500 ft. (2,590 m.).
Min. speed (power on) 30 m.p.h. (49.6 km.h.).
Min. speed (power off) 41 m.p.h. (65.6 km.h.).
Initial rate of climb 1,100 ft./min. (335 m./min.).
Service ceiling 25,600 ft. (7,810 m.).
Range 600 miles (960 km.).
Take-off distance to 50 ft. (15.25 m.) 165 yds. (152 m.).

HILLER

HILLER HELICOPTERS.

Head Office: 1,350, Willow Road, Palo Alto, California.

President: Stanley Hiller, Jr.

Vice-Presidents: A. J. M. Chadwick and A. W. B. Vincent.

Chief Engineer: Robert Wagner.

Secretary and Treasurer: I. T. Kitzmiller.

During 1954 Hiller Helicopters continued as its major production activity the building of H-23 military helicopters for the U.S. Army and became a key manufacturer of helicopters for the Army's constantly expanding helicopter programme. Commercial 12-B helicopters were also sold to commercial customers and foreign governments throughout the World.

An additional quantity of the Hornet ram-jet helicopter was ordered by the Government for field evaluation testing as a follow-up to the initial quantity for evaluation at military centres.

Hiller was successful in winning one of two contracts awarded by the U.S. Navy Bureau of Aeronautics for the development of a portable one-man helicopter designated XROE-1.

Some details of the Hiller "Flying Platform" were released in 1955. This research vehicle is illustrated on the next page.

The company is also engaged in contractual study projects dealing with large helicopter designs and operations.

The Hiller 8RJ2B ramjet engine which powers the Hornet helicopter was, in 1955, awarded an Approved Type Certificate by the C.A.A. The engine thus becomes the first ramjet power-unit to be certificated in the United States and also the first CAA-approved tip-mounted power-plant for helicopters. Details of this power-unit will be found in the Engine Section of this book.

The Hiller HJ-1 Hornet Helicopter (two Hiller 8RJ2B rotor-tip ramjets).

THE HILLER XROE-1.

Hiller has been awarded a contract by the U.S. Navy Bureau of Aeronautics for the development and production of a prototype one-man portable "rotocycle" for the U.S. Marine Corps. The design calls for a craft which can be collapsed into a small package for easy transportation or parachute drop, and one that can be quickly dismantled and re-assembled. Its uses will include observation, liaison, escape and evasion, etc.

The XROE-1 will have a single two-blade main rotor with a small anti-torque tail rotor, and propulsion will be by a Nelson four-cylinder opposed two-stroke air-cooled piston engine. No other details are available.

The Hiller H-24B Army Evacuation Helicopter.

THE HILLER MODEL HJ-1 HORNET.

U.S. Army designation: YH-32.
U.S. Naval designation: HOE-1.

Type.—Two-seat Ramjet-driven Helicopter.

Rotor System.—Two-blade all-metal rotor. Solid extruded aluminium leading-edge and built-up magnesium trailing-edge. Hiller "Rotor-Matic" cyclic-pitch control system as used in the 260. Rotor blade area 18.2 sq. ft. (1.69 m.^{2}). Rotor diameter 23 ft. (7 m.).

Fuselage.—Combination Fiberglas and steel-tube structure. A cabin enclosure having a Fiberglas and plastic laminate skin and Plexiglas windscreen can be installed and detached in a few minutes.

Tail Unit.—Small 1 ft. 4 in. (0.35 m.) diameter tail rotor used to provide directional control only.

Landing Gear.—Simple twin skid gear.

Power Plant.—Two Hiller 8RJ2B ramjet units attached to extremities of rotor blades by two shear-type bolts each. All electric and fuel connections of plug-in type. Each unit, which has no moving parts, develops the equivalent of 45 h.p. and weighs 12.7 lb. (5.76 kg.). Fuel is pressure fed to ramjets by separate pipes from tank in fuselage. Rotor must be spun up to 50 r.p.m. by auxiliary means before ramjets can be started. This done by small 1 h.p. gasoline engine which is started by rip-cord, but can be achieved by hand-cranking or small electric motor. Starting procedure is then as follows:—fuel flow valves are opened and starter button is depressed. This button activates a magneto which energises electrodes in the ramjet units, which then fire. When 550 r.p.m. is reached the helicopter may be taken off. Fuel capacity 52 U.S. gallons (196.5 litres).

Accommodation.—Open or enclosed accommodation for two side-by-side on cross-bench seat. Baggage compartment behind seat in cabin enclosure.

Controls.—Hiller "Rotor-Matic" paddle control system with cyclic-pitch control column branched at upper end to make it accessible to both occupants. Collective-pitch levers, which also incorporate the fuel flow valve are located conveniently between the two occupants. Foot pedals are provided for directional control.

DIMENSIONS.—
Rotor diameter 23 ft. (7.0 m.).
Fuselage width 3 ft. 9 in. (1.14 m.).
Overall height 8 ft. (2.44 m.).
WEIGHTS.—
Empty 510 lb. (231 kg.).
Max. useful payload 510 lb. (231 kg.).
Loaded 1,080 lb. (489 kg.).
PERFORMANCE.—
Max. speed 80 m.p.h. (128 km.h.).
Initial rate of climb 970 ft./min. (295 m./min.).
Hovering ceiling in ground effect 3,500 ft. (1,066 m.).
Service ceiling 11,500 ft. (3,510 m.).
Normal still air range 31 miles (50 km.).

THE HILLER MODEL 12B.
U.S. Army designation : H-23.
U.S. Navy designation: HTE.

The Model 12B was conceived and developed primarily as a military helicopter for the evacuation of wounded, training and other military missions.

The 12B was granted Approved Type Certificate No. 6H2 by the C.A.B. in November, 1951, and it is now in production as a utility helicopter for commercial use, as well as in the following military versions :—

H-23B. Air evacuation helicopter for the U.S. Army. Stretcher installation consists of two folding stretchers in heated carriers, one on each side of cabin. May also be used for training. Wide track skid landing-gear.

H-23C. Current production version for U.S. Army. Deliveries began in Autumn of 1955.

HTE-2. Two-seat training helicopter for U.S. Navy. Four-wheel landing-gear. Twenty HTE-2's supplied to the Royal Navy.

TYPE.—Two-seat Training or three-seat Utility Helicopter.

ROTOR SYSTEM.—Two-blade main rotor universally mounted on power shaft with small servo rotor, the latter connected directly through universally-mounted transfer bearing and simple linkage with pilot's control stick. Movement of control stick introduced to the servo rotor paddles positive or negative pitch changes and aerodynamic forces thus developed tilt the rotor head and produce the effect of cyclic pitch changes to the rotor blades. Two-blade anti-torque rotor at rear end of fuselage driven off engine through universal joint and shafting. Main rotor/engine r.p.m. ratio 1 : 9 17. Anti-torque rotor/engine r.p.m. ratio 1 : 1.6. The main rotor blades are of solid wood laminations with a steel spar along the leading-edge for balance purposes. Covering is of Fiberglas with a stainless-steel leading-edge.

The Hiller HTE-2 Naval Training Helicopter.

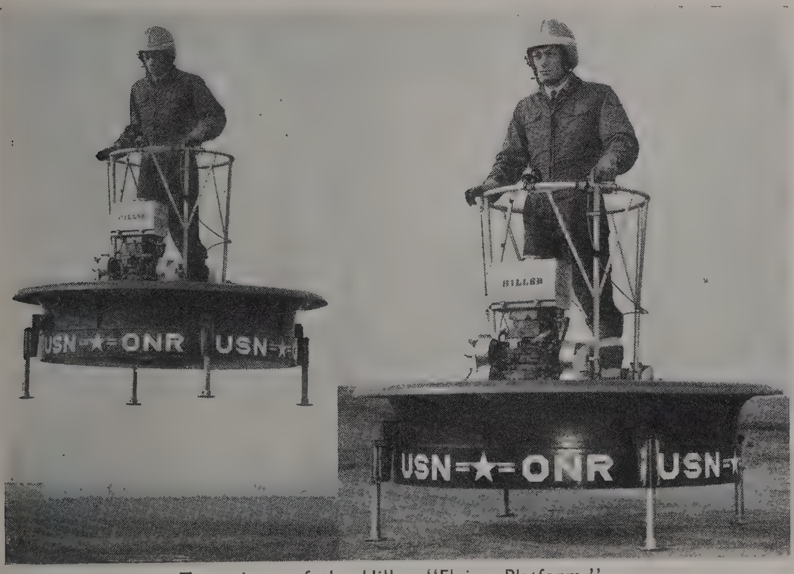
FUSELAGE.—Fabricated sheet metal fully-stressed semi-monocoque platform structure supports the non-stressed cabin enclosure, seats and controls, engine mounting and landing-gear. Tail boom of beaded sheet metal with no internal stiffeners.

LANDING GEAR.—Wide-tread skid (H-23 and 12B) or four-wheel type (HTE). Skid gear has two small wheels at rear to facilitate ground handling. Skid track 7 ft. 6 in. (2.28 m.). Four-wheel type has Hiller air/oil shock struts.

POWER PLANT.—One 200 h.p. Franklin Model 6V4-200-C33 six-cylinder horizontally-opposed fan-cooled engine mounted with main shaft vertical on steel-tube quadrapod attached to fuselage platform by four bolts. Rotor transmission through single planetary gear assembly. Fuel capacity 28 U.S. gallons (106 litres).

ACCOMMODATION.—Enclosed cabin seating three. Floor type cyclic pitch control columns with collective pitch levers on left side of seats. Electric trim on cyclic column and throttle friction adjustment on collective pitch levers. The H-23B casualty evacuation version carries two folding type litters, one either side of cabin. Litter carriers are heated. A convertible cabin or canopy is standard on the civil Model 12B. This model can be easily adapted for agricultural operations, using dust, spray or aerosol equipment.

DIMENSIONS.—
Main rotor diameter 35 ft. (10.67 m.).
Length 38 ft. 8 in. (11.8 m.).
Height to top of rotor head (on wheels) 9 ft. 6 in. (2.89 m.).
Height to top of rotor head (on skids) 9 ft. 9½ in. (2.98 m.).
Diameter of tail rotor 5 ft. 6 in. (1.67 m..)
WEIGHTS AND LOADINGS.—
Weight empty (12B) 1,656 lb. (752 kg.).
Weight empty (H-23B) 1,737 lb. (788.5 kg.).
Weight empty (HTE-2) 1,754 lb. (796 kg.).
Disposable load (12B) 844 lb. (383 kg.).
Weight loaded 2,500 lb. (1,135 kg.).
Disc loading 2.6 lb./sq. ft. (12.68 kg./m.^{2}).
Power loading 12.5 lb./h.p. (5.67 kg./h.p.).
Disposable load (H-23B) 763 lb. (346.5 kg.).
Disposable load (HTE-2) 746 lb. (339 kg.).
PERFORMANCE.—
Max. speed 84 m.p.h. (134.4 km.h.).
Cruising speed 70 m.p.h. (112 km.h.).
Max. rate of climb 770 ft./min. (235 m./min.).
Hovering ceiling in ground effect 3,200 ft. (976 m.).
Absolute ceiling 9,400 ft. (2,867 m.).
Range 135 miles (216 km.).



Two views of the Hiller "Flying Platform."

THE HILLER "FLYING PLATFORM."

The "Flying Platform" is a research vehicle which has been designed and built for the Office of Naval Research. It employs the ducted fan principle of lift and propulsion, the co-axial contra-rotating fans being enclosed in a ring, the upper lip of which is flared outward. The induced flow of air through the ring, which is approximately 6 ft. (1.83 m.) in diameter, reduces air pressure over the lip, thus making the pressure under the lip relatively greater. The fans are driven by two Nelson H-56 air-cooled engines.

Control of the flying platform is by engine throttle for vertical movement or by the pilot shifting his weight, or leaning in the direction in which he wishes to go, for directional movement.

Hiller received a contract for the development of the free flight platform in 1954. The first free flight was made on February 4, 1955.

The platform is being used for research only, principally to test the principle of stabilised control with a ducted fan.

JACOBS

JACOBS AIRCRAFT ENGINE COMPANY.

HEAD OFFICE AND WORKS : POTTSTOWN, PENNSYLVANIA.
President : R. Eberstadt.
Vice-President, Treasurer and General Manager : Floyd J. Sisto.
Vice-President, Manufacturing and Engineering : Cleeman Withers.
Secretary : R. F. Danley.

The Jacobs Aircraft Engine Company, hitherto known as a manufacturer of radial air-cooled engines, has formed a Helicopter Division and is engaged in the development of a convertiplane, details of which are given hereafter.

The Model 104 Gyrodyne, or convertiplane, has been designed to fulfil a need for a high-speed low-cost aircraft for short range operation. The main feature of the Model 104 is the Jacobs-designed engine transmission "package" unit which is claimed to be 20% lighter per transmitted horsepower than other helicopter installations of comparable power. The weight saved by this packaged combination of engine and the complete transmission system permits the carrying of an extra passenger.

The fuselage construction is also

interesting. The contour lines are second-degree conic shapes as developed by Liming-Hartley of North American Aviation, Inc. By using moulded Fiberglas or Plexiglas panels as a covering for the forward fuselage high strength is obtained with light weight and the exterior does not require a doped or painted finish.

The Type 104 employs the "unloaded rotor" gyrodyne layout in which a helicopter configuration is augmented by the addition of lifting wings and a propeller for forward flight. Power is delivered to the rotor system for vertical and hovering flight or to the tail propeller for horizontal flight. In the latter condition the wings provide the major part of the lift while the rotor autorotates at its lowest drag configuration.

A flying mock-up of the Type 104 made its first flight in October, 1953.

The flying mock-up of the Jacobs Model 104 in hovering flight. (*Howard Levy*).

THE JACOBS MODEL 104.

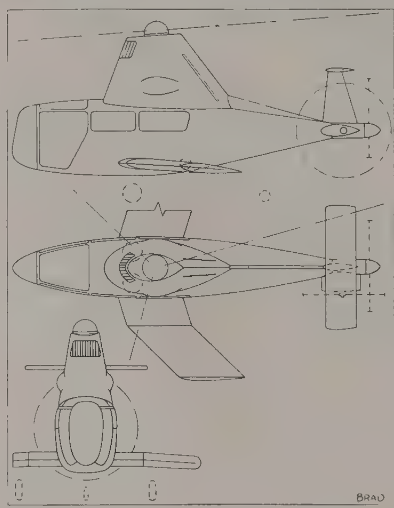
TYPE.—Five-seat Gyrodyne or Convertiplane.

MAIN ROTOR.—Three-blade main rotor. NACA 23015 aerofoil section. Each blade is a 61ST aluminium-alloy extrusion. Blade chord 10 in. (25.4 cm.). Radius from centre-line of hub 18 ft. (5.5 m.). Twist 8°. Tip speed 554 ft./sec. (169 m./sec.). Blade attached to hub through non-friction type ball-socket joints which replaces the conventional vertical and horizontal pins. Jacobs blade-positioning linkage on top of hub holds blades in their related azimuth positions and eliminates lag dampers. Diameter of main rotor 36 ft. (11 m.). Rotor disc area 1,018 sq. ft. (94.5 m.²).

TAIL ROTOR AND PROPELLER.—Both are three-bladed and are geared to intermesh in planes 90° apart. The blades of both are 24ST aluminium-alloy extrusions, have an NACA 0009 aerofoil section and a chord of 3.75 in. (9.5 cm.). Both have pitch control, and are driven at approximately engine speed through a drive shaft from the main rotor gear-box and a small tail gear-box. Diameter of anti-torque rotor 6 ft. (1.83 m.). Disc area of anti-torque rotor 28.25 sq. ft. (2.6 m.²). Diameter of propeller 6 ft. 6 in. (1.98 m.).

WINGS.—Cantilever structure providing approximately 30% of the total lift. Aerofoil section NACA 63024 to 63018. Mean geometric chord 4 ft. (1.22 m.). Effective sweepback 45°. Two-spar light alloy (24ST) structure. Wings contain integral fuel cells.

FUSELAGE.—Forward and mid section of welded steel tubing covered with moulded Fiberglas or Plexiglas. Rotor pylon has a symmetrical aerofoil shape and cover is divided into half sections which may be removed individually for access to engine-transmission unit. Tail cone of aluminium alloy, the bulkheads containing supports for the rear rotor and propeller drive shafts.



The Jacobs Model 104 Gyrodyne.

TAIL UNIT.—Of similar construction to wings. Horizontal tail surface, mounted on top of tapered vertical fin, has trim adjustment. Area of horizontal surface 14.5 sq. ft. (1.35 m.²). Area of vertical fin 4.35 sq. ft. (0.41 m.²). Span of tail 7 ft. 10 in. (2.380 m.).

LANDING GEAR.—Retractable tail-wheel type. Hydraulic retraction. Electrol main shock-absorber struts, Jacobs tail-wheel strut. Track 8 ft. 9 in. (2.66 m.).

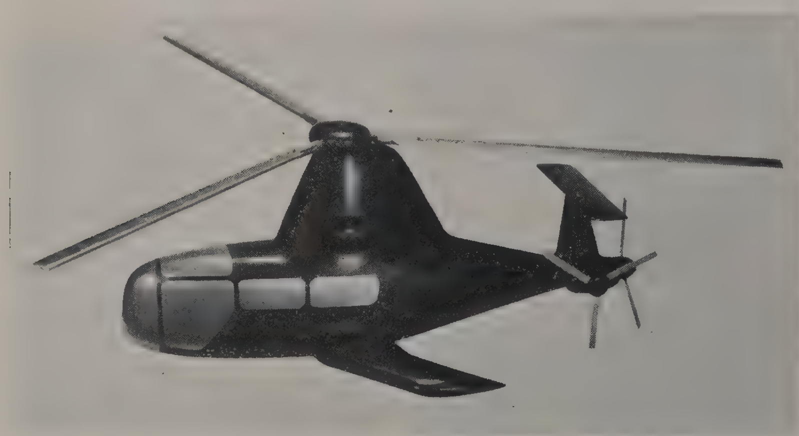
POWER PLANT.—Jacobs R-755-EH engine transmission unit consisting of a 350 h.p. Jacobs R-755-E radial engine with extended front cover section enclosing a friction and over-running clutch and reduction gear-box transmissions for both main and tail rotors. A cooling fan is mounted on the vertical main rotor drive shaft. Entire self-contained unit mounted above fuselage in faired pylon and insulated from main structure with rubber mounts. Main rotor/engine r.p.m. ratio 1 : 8.5. Anti-torque rotor and propeller/engine r.p.m. ratio 1 : 1.042. Fuel in integral cells in outer wings. Fuel capacity 53 U.S. gallons (200 litres). Oil capacity 5 U.S. gallons (19 litres).

ACCOMMODATION.—Enclosed cabin seating pilot and four passengers. Control unit beneath pilot's seat serves to co-ordinate the various control motions of the collective-pitch and cyclic-pitch sticks into a single group of three bell-cranks. When flown as a gyrodyne the collective-pitch stick is locked in the down position and the aircraft is controlled with cyclic-pitch stick and rudder pedals as a normal aeroplane.

DIMENSIONS.—
- Main rotor diameter 36 ft. (11.0 m.).
- Max. overall length 32 ft. 11 in. (10.0 m.).
- Min. overall length 26 ft. 4 in. (8.0 m.).
- Span of wings 14 ft. (4.27 m.).
- Overall height 10 ft. 10 in. (3.3 m.).

WEIGHTS AND LOADINGS (Designed).—
- Weight empty 2,350 lb. (1,067 kg.).
- Disposable load (with 4 passengers) 1,125 lb. (511 kg.).
- Weight loaded 3,475 lb. (1,578 kg.).
- Disc loading 3.41 lb./sq. ft. (16.64 kg./m.²).
- Power loading 9.93 lb./h.p. (4.5 kg./h.p.).

PERFORMANCE (Estimated).—
- Max. speed 175 m.p.h. (280 km.h.).
- Cruising speed 157 m.p.h. (251 km.h.).
- Rate of vertical climb 700 ft./min. (214 m./min.).
- Hovering Ceiling 5,500 ft. (1,680 m.).
- Absolute ceiling 14,000 ft. (4,270 m.).
- Range 260 miles (416 km.).



A model of the Jacobs Model 104 Gyrodyne.

KAMAN

KAMAN AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: OLD WINDSOR ROAD, BLOOMFIELD, CONNECTICUT.

President: Charles H. Kaman.

The Kaman Aircraft Corpn. was formed on December 12, 1945, to develop a new helicopter rotor and control system evolved by Mr. Charles H. Kaman.

The basic development of an intermeshing rotor system and servo flap control was completed late in 1946 and the first flight of the Kaman K-125A experimental helicopter was made on January 15, 1947. This was followed by the K-190, which flew in April, 1948. In December of that year the C.A.A. gave structural approval for the production of the K-225 utility helicopter, and certification of this model was granted by the C.A.A. in April, 1949.

In 1949 Kaman was awarded a research contract by the U.S. Navy, calling for the evaluation of the flight stability and handling characteristics of the K-225.

In 1950 Kaman received two production contracts from the U.S. Navy for two new types of helicopter using the same type of intermeshing rotors and servo rotor

control which have characterised Kaman helicopters since their inception. These contracts were for undisclosed quantities of HTK-1 three-seat trainers and HOK-1 four-seat liaison helicopters.

Under contract to the U.S. Navy Office of Naval Research, Kaman has developed a rotorchute for the standard military M2 air-drop container. The rotorchute, which is attached to one end of the container, has two blades which fold back through 90 degrees and telescope to one-half their normal length to permit the container and its rotorchute to be carried on the external bomb rack of a high-speed aircraft. When dropped the rotor blades begin spinning automatically and swing to their full rotating position. Centrifugal force extends them to their full length and the M2 container descends at a slow rate to the ground. The rotorchute is much less susceptible to wind drift than a parachute, making possible pin-point landings within small areas.

The Kaman HTK-1 Training Helicopter. (*Gordon Williams*).

THE KAMAN HTK-1.

The HTK-1 three-seat helicopter is in production for the U.S. Navy and Marine Corps primarily as a trainer, but it is adaptable as an ambulance.

It uses the contra-rotating and intermeshing twin rotor system, with servo-flap control, which has been the feature of all Kaman helicopters.

In this system the solid spruce rotor blades are attached to the hub only by blade lag hinges, the servo flaps eliminating blade-pitch change and associated bearings. The movements of the servo flaps twist the blades, the natural resilience of the blade material being used to obtain torsional deflection.

The HTK-1 also has a horizontal tail surface connected to the collective-pitch control for greater stability to permit "hands-off" flying.

Power is supplied by a 240 h.p. Lycoming O-435 engine.

For evacuation duties the HTK-1 can carry a pilot and two stretcher cases, one above the other on the left side of the cabin. The left half of the transparent cabin nose opens to facilitate the loading of the stretchers. The change-over from three-seat trainer to ambulance can be made in $2\frac{1}{2}$ minutes.

This helicopter has been awarded a C.A.A. Approved Type Certificate (1H3) and has a commercial designation (K-240) but it will not be produced in civil form until military commitments permit.

DIMENSIONS.—
- Rotor diameter (both) 40 ft. (12.20 m.).
- Distance between rotor heads 4 ft. 10 in. (1.47 m.).
- Length of fuselage (over fins) 20 ft. $6\frac{1}{2}$ in. (6.25 m.).
- Span of tail 8 ft. 0 in. (2.44 m.).
- Wheelbase 6 ft. 2 in. (1.88 m.).
- Track (rear wheels) 7 ft. 6 in. (2.28 m.).
- Track (front wheels) 5 ft. 2 in. (1.57 m.).

WEIGHTS.—
- Combat weight (pilot + 1 and 20 U.S. gallons of fuel) 2,750 lb. (1,248 kg.).
- Normal loaded weight (pilot + 1 and 40 U.S. gallons of fuel) 2,870 lb. (1,303 kg.).
- Max. loaded weight (pilot + 3 stretcher cases and 15 U.S. gallons of fuel) 3,100 lb. (1,407 kg.).

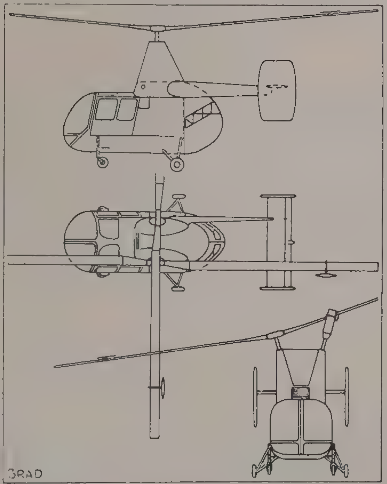
PERFORMANCE (at designed gross weight).—
- Max. speed 81 m.p.h. (130 km.h.).
- Max. rate of climb 1,050 ft./min. (320 m./min.).
- Hovering ceiling in ground effect 5,700 ft. (1,740 m.).
- Service ceiling 14,500 ft. (4,420 m.).

PERFORMANCE (at combat weight).—
- Max. speed 81 m.p.h. (130 km.h.).
- Max. rate of climb 1,300 ft./min. (396 m./min.).
- Hovering ceiling in ground effect 6,700 ft. (2,043 m.).
- Service ceiling 17,000 ft. (5,185 m.).

Under a joint Army-Navy development contract one HTK-1 has been fitted with two Boeing 502-2 shaft turbine engines in place of the single standard Lycoming piston engine. The two turbine engines, which together produce 380 shaft h.p., are placed side-by-side, a simple gear-box transferring the dual power to the standard HTK-1 rotor drive system.

Normally both turbines are used for vertical take-off and hovering with heavy loads, while one turbine is shut off for cruising in horizontal flight.

The turbine-powered HTK-1 made its first flight on March 26, 1954.



The Kaman HOK-1 Helicopter.

THE KAMAN "DRONE" HELICOPTER.

Kaman has designed and built a remote-control helicopter as a research and development vehicle under a contract with the U.S. Navy Office of Naval Research. The "drone" helicopter is basically an HTK-1 which has been modified and fitted with the necessary apparatus to enable it to be flown by an operator of a ground control station.

Although the control system employed is somewhat similar to that used for the remote control of fixed-wing aircraft, the problems which had to be overcome by Kaman were far more complex owing to the helicopter's ability to rise and descend vertically, hover and fly forward, backward and sideways. In addition to the remote-control system, Kaman had to develop a small auto-pilot and the miniature gear-boxes to be used with the system.

At the time of writing the "drone" helicopter had done over one hundred hours of remote-control flying, including take-offs and landings, backward, forward, sideways and hovering flight. All these flights were made with a safety pilot aboard and within the visual range of the ground operator.

THE KAMAN HOK-1.

The HOK-1 is a four-seat liaison helicopter which is in production for the U.S. Navy and Marine Corps. This contract was the result of success in a Navy-sponsored design competition for a liaison-type helicopter. This contest took place at the same time as the U.S. Navy was conducting evaluation flight tests with an earlier type of Kaman helicopter. The results of these tests with a craft using the same rotor system as that incorporated in the competitive design had their influence on the final award of the contract.

The HOK-1 normally carries four persons but as an ambulance it can accommodate two stretcher patients and one sitting patient or medical orderly, in addition to the pilot. Stretcher loading is through the nose.

The HOK-1 is powered by a 600 h.p. Pratt & Whitney R-1340 radial engine which is mounted at the rear end of the fuselage at an angle of 35° from the horizontal to give direct drive to the dual rotor gear box in the roof. The engine is fan-cooled with the shutter-controlled main air inlet between the rotor pylons. Large rear fuselage doors give complete access to the power-plant.

The two rotors can be lined up parallel to each other fore and aft for stowage purposes.

The Kaman HOK-1 Liaison Helicopter. (*Levy-Shipp*).

KELLETT

THE KELLETT AIRCRAFT CORPORATION.

Head Office and Works: Central Airport, Box 468, Camden 1, New Jersey.

President: J. T. Duffy, Jr.

Acting Chief Engineer, Executive Administration: C. E. Schneck.

Acting Chief Engineer, Design: A. E. Larsen.

Manager, Manufacturing: P. E. Henninger.

Treasurer and Controller: J. N. Brown.

Secretary: G. P. Williams III.

The Kellett Aircraft Corporation was founded in 1929, and has since been engaged in the development of rotary-wing aircraft. The Company developed and supplied to the U.S.A.F. the first military Autogiros, as well as the first Autogiros to Brazil and Argentina.

The Company designed and developed the XR-8 and XH-10 helicopters for the U.S.A.F. It also designed the XH-17 large transport helicopter but the development of this design and the construction of the prototype was transferred to the Hughes Aircraft Company in 1948.

The Company's present activities consist of further development work on helicopters and aircraft engineering and manufacturing on a sub-contract basis.

Kellett currently holds a contract from the U.S. Navy to convert a 1939 Kellett KD-1B Autogiro into a flying test vehicle to investigate the flight of a partially-loaded rotor system to provide performance characteristics for a compound helicopter-type convertiplane.

The company has also completed the KH-15, a small single-seat rocket-powered research helicopter, brief details of which follow. The KH-15 made its first flight on May 13, 1954.

THE KELLETT KH-15.

The KH-15 is a single-seat jet-driven research helicopter which has been developed under a contract from the Office of Naval Research for in-flight investigation of a gyratory stabilised control system developed by Kellett.

The KH-15 has been designed to allow a large variation of the control parameters affecting the control and stability characteristics of a helicopter. Thus, a large number of control combinations can be set up and tested without modification to the basic structure.

The general arrangement of the KH-15 can be gathered from the accompanying illustration. Power is supplied by two small Reaction Motors' rocket engines mounted at the tips of the main rotor blades. A conventional variable-pitch tail rotor provides directional control. The fuel tanks, one on each side of the pilot, for hydrogen peroxide are pressurised with nitrogen. The fuel system incorporates a pilot-operated manual throttling valve.

Dimensions.—
Diameter of main rotor 18 ft. (5.49 m.).
Total disc area 254.4 sq. ft. (23.6 m.^{2}).
Diameter of tail rotor 2 ft. 3 in. (0.68 m.).
Overall length 18 ft. (5.49 m.).
Overall width (blades fore and aft) 8 ft. 1 in. (2.47 m.).
Max. height approx. 8 ft. (2.44 m.).

Weights.—
Weight empty 234 lb. (106 kg.).
T.O. weight 644 lb. (292 kg.).

Performance.—
No data available.

The Kellett KH-15 Jet-driven Helicopter.

LAMSON

LAMSON AIRCRAFT COMPANY, INC.

Head Office: 807, Fourth Avenue, Seattle, Wash.

Works: P.O. Box 468, Municipal Airport, Yakima, Wash.

President: Robert L. Lamson.

Executive Vice-President and Treasurer: L. E. J. Lafarge.

Vice-President and General Manager: James A. Clark, Jr.

Secretary: John H. Powel.

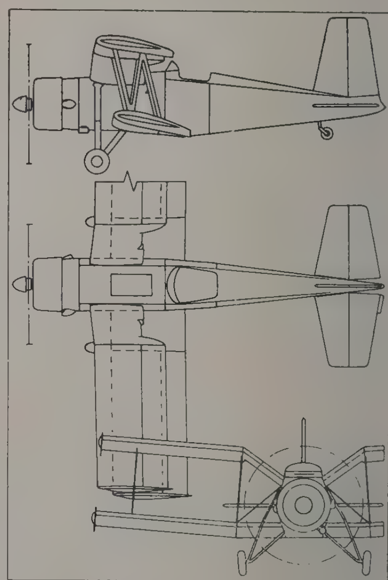
The Lamson Aircraft Company, Inc. is responsible for the manufacture of the Air Tractor which has been specially designed for all kinds of agricultural work, including dusting, spraying, seeding, fertilising, weed-killing, timber spraying, etc. Particular attention has been paid to evolving an aircraft which will be easy and cheap to maintain and operate. All four-wing panels, the flaps and ailerons, interplane struts and all tail surfaces are identical and interchangeable.

The prototype Air Tractor flew for the first time on December 10, 1953, and the first production Air Tractor flew on December 18, 1954. The award of an Approved Type Certificate was expected in mid-1955.

THE LAMSON MODEL L.101 AIR TRACTOR.

Type.—Single-engined Agricultural biplane.

Wings.—Equal-span braced biplane. NACA 6515 high-lift wing section. Chord 5 ft. 6 in. (1.67 m.). Dihedral 4°. Incidence 8°. Gull-wing upper centre-section, rigidly-braced lower stub wings. All four outer wing panels identical and interchangeable, with attachment fittings at each end. N-type interplane struts. Double wire-bracing in planes of upper and lower front spars. Large end-plates at wing tips. Trailing-edges of panels hinged, upper hinged surfaces acting as ground-adjustable flaps and lower surfaces as ailerons. All four hinged surfaces are identical and interchangeable. Wing structure of wood with fabric covering. Total aileron area 44.2 sq. ft. (4.1 m.^{2}). Gross wing area 350 sq. ft. (32.5 m.^{2}).



The Lamson Air Tractor.

The Lamson Air Tractor (450 h.p. Pratt & Whitney R-985 engine).

Fuselage.—Welded steel-tube rigidly-braced framework covered with aluminium sheet.

Tail Unit.—Braced monoplane type. All surfaces, fixed and movable, identical and interchangeable, special hinges making it impossible to instal incorrectly. Welded steel-tube frames covered with fabric. Areas: fin 12.8 sq. ft. (1.18 m.^{2}), rudder 12.8 sq. ft. (1.18 m.^{2}), tailplane 25.6 sq. ft. (2.36 m.^{2}), elevators 25.6 sq. ft. (2.36 m.^{2}). Span of tail 13 ft. (3.96 m.).

Landing Gear.—Fixed tail-wheel type. Bendix air-oil shock-absorbers. Goodyear wheels and single or multiple disc brakes. Track 10 ft. 8 in. (3.25 m.).

Power Plant.—One 450 h.p. Pratt & Whitney R-985 nine-cylinder radial air-cooled engine. Hamilton Standard 2D30 two-blade variable-pitch airscrew. Fuel

tank in fuselage, capacity 84 U.S. gallons (317.5 litres).
ACCOMMODATION.—Open pilot's cockpit aft of trailing-edge of lower wings. Fuselage hopper of up to 50 cub. ft. capacity for 2,000 lb. (908 kg.) of dust or spray.
DIMENSIONS.—
Span 33 ft. 7 in. (10.24 m.).
Length 26 ft. 8 in. (8.13 m.).
Height 11 ft. 3 in. (3.43 m.).
WEIGHTS.—
Weight empty 2,970 lb. (1,348 kg.).
Weight loaded 5,500 lb. (2,497 kg.).
PERFORMANCE (with 2,000 lb. = 908 kg. of chemicals).—
Take-off run 990 ft. (302 m.).
Rate of climb (Temperature 50°F., wind 0-2 m.p.h., altitude of field 1,070 ft. = 375 m.) 450 ft./min. (137 m./min.).
Landing run 950 ft. (290 m.).
PERFORMANCE (with 1,500 lb. = 680 kg. of chemicals).—
Take-off run 410 ft. (125 m.).
Rate of climb 950 ft./min. (290 ft./min.).
Landing run 390 ft. (119 m.).

The Lamson Air Tractor (450 h.p. Pratt & Whitney R-985 engine).

LEAR

LEAR, INCORPORATED.

HEAD OFFICE AND WORKS: 3171, S. BUNDY DRIVE, SANTA MONICA, CALIFORNIA.

Chairman of the Board and Director of Research and Development: W. P. Lear.
President: R. M. Mock.
Vice-President and Director of Sales: A. G. Handschumacher.
Vice-President, Customer Relations: Dean C. Smith.
Vice-President, Engineering: C. J. Breitwieser.
General Manager, Aircraft Engineering Division: J. Nelson Kelly.
Secretary: Philip E. Golde.
Treasurer: C. D. Seftenberg.

Lear, Incorporated, was founded by William P. Lear in 1930. The company has grown to become one of the World's leading designers and producers of high-precision electrical, electronic, and mechanical accessories, devices, and instruments for the aviation industry. Products include motors, temperature and positioning controls, gear mechanisms, actuators, gyro-stabilized automatic flight control systems, gyro instruments, radio communications and navigation equipment, liquid and air pumps, desiccators, dehydrators, pressurizing kits and heat exchangers.

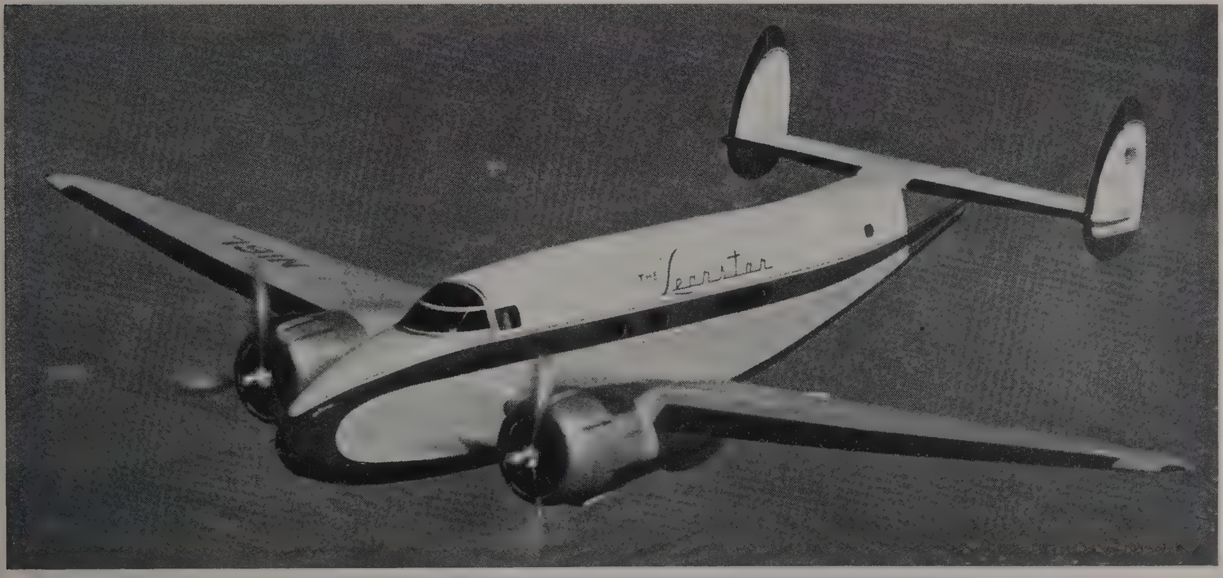
The Aircraft Engineering Division of Lear, Inc. was formed on September 15, 1953. The principal product of this division is the Learstar high-speed long-range transport, designed and built specifically for executive use by business firms. The Learstar is built around certain basic components of the Lockheed Model 18-56 Lodestar. All such components are, however, extensively modified, all operating systems of the aircraft are of entirely new design and construction, and the performance of the aircraft far exceeds that of the Lodestar.

The first prototype Learstar made its initial flight May 10, 1954, and the first production aircraft flew on October 19, 1954. In January, 1955, the Learstar was certificated by the C.A.A. in the Airline Transport Category, Civil Aeronautics Regulations, Part 4b. On February 26, 1955, the first customer delivery of a Learstar was made to the British American Oil Company, Ltd., of Toronto, Canada. Subsequent deliveries are scheduled at the rate of two per month.

Of all twin-engined transport aircraft currently in production, the Learstar is the fastest and has the longest non-stop range.

THE LEARSTAR.

TYPE.—Twin-engined Executive Transport.
WINGS.—Low-wing cantilever monoplane. NACA 2300 Series (modified) wing section. Aspect ratio 7.79. Chord 13 ft. 9.3 in. (4.19 m.) at root, 4 ft. 0.8 in. (1.22 m.) at tip. Dihedral 6° 15′ at chord line. Incidence 2°. Aluminium-alloy flush-riveted structure. All-metal ailerons with trim and balance tabs. All-metal Fowler type flaps inboard of ailerons. Total area of ailerons 35 sq. ft. (3.25 m.^{2}). Total area of flaps 107.5 sq. ft. (99.8 m.^{2}). Gross wing area 551 sq. ft. (51.18 m.^{2}).
FUSELAGE.—Aluminium-alloy monocoque structure with flush-riveted skin.
TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. Aluminium-alloy construction. Areas: fins (2) 29.3 sq. ft. (2.72 m.^{2}), rudders (2) 34.8 sq. ft. (3.23 m.^{2}), tailplane 82.6 sq. ft. (7.66 m.^{2}), elevators (total) 40.4 sq. ft. (3.75 m.^{2}). Span of tailplane 23 ft. 2 in. (7.06 m.).
LANDING GEAR.—Retractable tail-wheel type. Cleveland Pneumatic air-oil shock-absorbers. Hydraulic retraction. Goodyear wheels and single-disc spot-type brakes. Track 15 ft. 4 in. (4.67 m.).
POWER PLANT.—Two Wright Cyclone R-1820-76A nine-cylinder radial air-cooled engines each rated at 1,425 h.p. for T.O. and 1,275 h.p. METO. Hamilton Standard Type 33D50-101/6511-12A airscrews. Fuel in six tanks, two front main (150 U.S. gallons = 567 litres each) and two rear main (172 U.S. gallons = 650 litres each) in centre-section and two outer wing tanks (235 U.S. gallons = 888 litres each). Total internal fuel capacity 1,114 U.S. gallons (4,211 litres). Oil capacity 38 U.S. gallons (144 litres).
ACCOMMODATION.—Crew of 2 and 8 to 12 passengers. Cabin furnishings and equipment according to customer's requirements. Toilet and galley.
DIMENSIONS.—
Span 65 ft. 6 in. (19.97 m.).
Length 51 ft. (15.55 m.).
Height 11 ft. (3.35 m.).
WEIGHTS.—
Weight empty 15,300 lb. (6,946 kg.).
Weight loaded 22,500 lb. (10,215 kg.).
PERFORMANCE.—
Max. speed 321 m.p.h. (514 km.h.).
Cruising speed (55% power) at 10,000 ft. (3,050 m.) 280 m.p.h. (448 km.h.).
Stalling speed with flaps 86.7 m.p.h. (138.7 km.h.).
Rate of climb at S/L. 1,710 ft./min. (532 m./min.).
Service ceiling at gross loading 26,700 ft. (8,145 m.).
Single-engine ceiling at gross loading 10,800 ft (3,295 m.).
Range 3,800 miles (6,080 km.).



The Learstar Executive Transport (two 1,425 h.p. Wright R-1820 engines).

The first prototype Lockheed YC-130 Transport (four 3,750 s.h.p. Allison T56 turboprop engines).

THE LOCKHEED AIRCRAFT CORPORATION.

Head Office and Works: Burbank, California.

Georgia Division: Marietta, Ga.

Missiles Systems Division: Van Nuys, California.

Other Factories: Bakersfield, and Palmdale, California.

Incorporated: 1932.

President and Chairman of Board: Robert E. Gross.

Executive Vice-President: Courtlandt S. Gross.

Vice-President and Assistant to President: Carl B. Squier.

Vice-President in charge of Administration: Cyril Chappellet.

Vice-President in charge of Engineering: Hall L. Hibbard.

Vice-President and Treasurer: C. A. Barker, Jr.

Vice-President and General Manager, California Division: Burt C. Monesmith.

Vice-President and General Manager, Georgia Division: Daniel J. Haughton.

Vice-President and General Manager, Missile Systems Division: Elwood R. Quesada.

Secretary: L. W. Wulfekuhler.

Controller: Dudley E. Browne.

The original Lockheed Aircraft Co. dates from 1916 when the brothers Allen and Malcolm Loughead, the founders, began with what was the forerunner of the true streamline aeroplane. The factory was moved to Burbank, Cal., the present site, in 1926, and the name changed to Lockheed.

On November 30, 1943, the Vega Aircraft Corporation, which had been formed in 1937 as an affiliate, and in 1941 became a wholly-owned subsidiary of the Lockheed Aircraft Corpn., was absorbed and the name Vega abandoned.

The company now employs around 45,000 persons, including about 15,000 at its new Marietta, Ga., division. The Marietta plant, a World War II government-owned facility, has been re-opened to build B-47 jet bombers and C-130A cargo transports.

The expansion of Lockheed facilities at Palmdale, California, has continued since 1952 and is approaching completion. The T-33 final assembly lines were transferred from Van Nuys to Palmdale in May, 1954.

With the F-94C Starfire jet interceptor contracts completed in 1954, Lockheed's current production includes the XF-104 air superiority fighter under development for the U.S.A.F., the XFV-1 vertical take-off turboprop fighter under development for the U.S. Navy; the T-33 jet trainer for the U.S.A.F. (and numerous N.A.T.O. countries); the TV-2 and T2V-2 jet trainers for the U.S. Navy; the P2V Neptune for the U.S. Navy; the WV-2 and RC-121 radar warning aircraft for the U.S. Navy and U.S.A.F. respectively; the Super-Constellation for airlines and the military services; and the B-47 jet bomber and C-130 turboprop medium cargo transport for the U.S.A.F.

A total of 650 Constellation series aircraft, both military and civil, have been built or are on order. In 1955 commercial Super Constellations will be coming off the production lines at a rate of more than one a week, while military production will continue through 1956.

Considerable research work in advanced flight fields is under way, including preliminary design studies on nuclear-powered aircraft under a contract with the U.S.A.F.

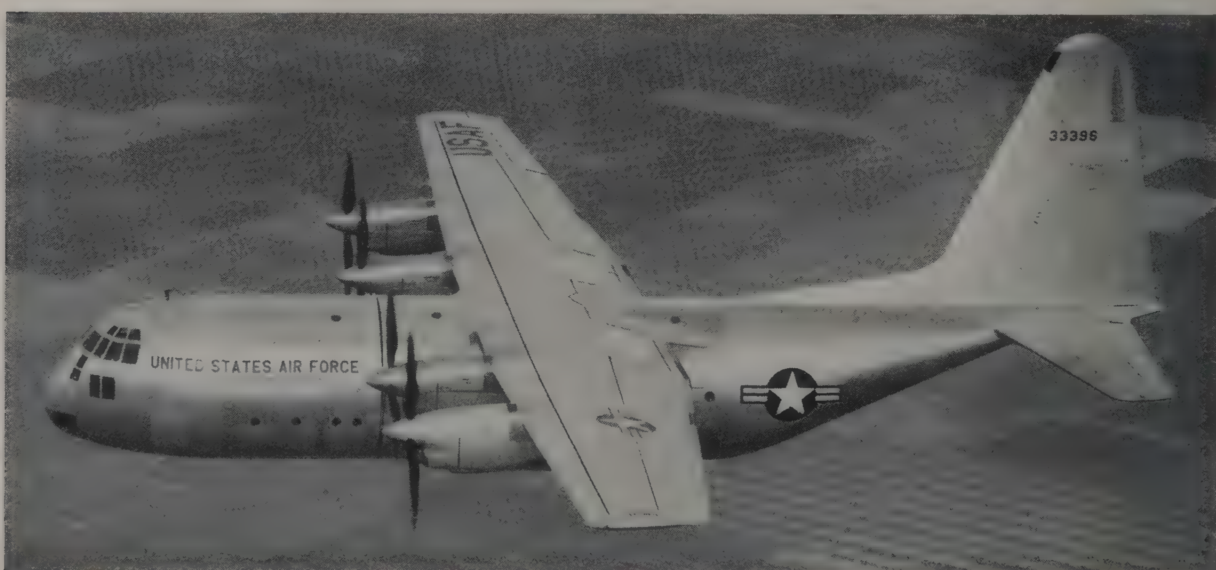
A new division, the Missile Systems Division, was formed in November, 1953, to bring together various projects and their staffs for the intensive prosecution of the design, development and production of pilotless aircraft and missiles. Previously such work was accomplished by separate specialized groups which concentrated on individual projects.

THE LOCKHEED HERCULES.

U.S.A.F. designation: C-130A.

The C-130A is a medium cargo transport which is in production for the U.S.A.F. at Marietta, Georgia. The first prototype YC-130 flew for the first time on August 23, 1954, and the first production C-130A made its maiden flight on April 7, 1955.

The C-130A, which is powered by four 3,750 h.p. Allison T56 turboprop engines, has been designed for assault and support



The second prototype Lockheed YC-130 Transport (four 3,750 h.p. Allison T56 turboprop engines).

A ground view of the first prototype Lockheed YC-130 (four 3,750 h.p. Allison T56 turboprop engines).

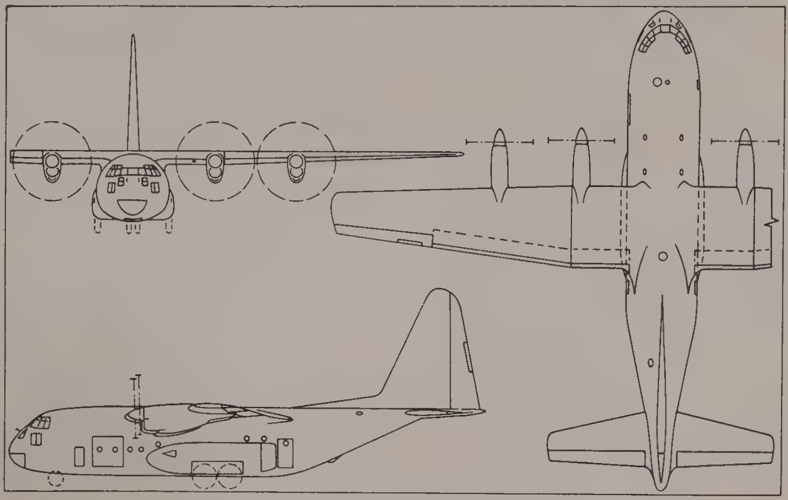
missions, carrying troops or supplies forward and returning casualties to the rear. As an assault transport the C-130A can carry 64 paratroops or 92 ground troops; as a cargo carrier it will be able to carry large pieces of equipment such as a 155 mm. howitzer and its high-speed tractor; and as an evacuation aircraft it can be rapidly converted to carry 70 stretcher cases plus 6 attendants.

Aft of the main hold, which is only 45 in. (1.14 m.) from the ground, the rear fuselage is sharply upswept. In the upswept portion is a built-in loading ramp which serves as the rear door. This ramp can be lowered to truck-bed height for loading stores, or to the ground for wheeled and tracked vehicles to be driven in. The rear door can also be opened in flight for the air dropping of paratroops and equipment. There is also a large cargo-loading door ahead of the wings.

The tricycle landing-gear, with the main wheels in tandem, is designed to permit the C-130A to operate from small emergency landing fields or rough forward airstrips.

All wheels are retractable, the main tandem-wheel units being raised vertically into the large fairings on the sides of the fuselage.

Dimensions (approximate).—
Span 132 ft. (40.2 m.).



The Lockheed C-130A Transport.

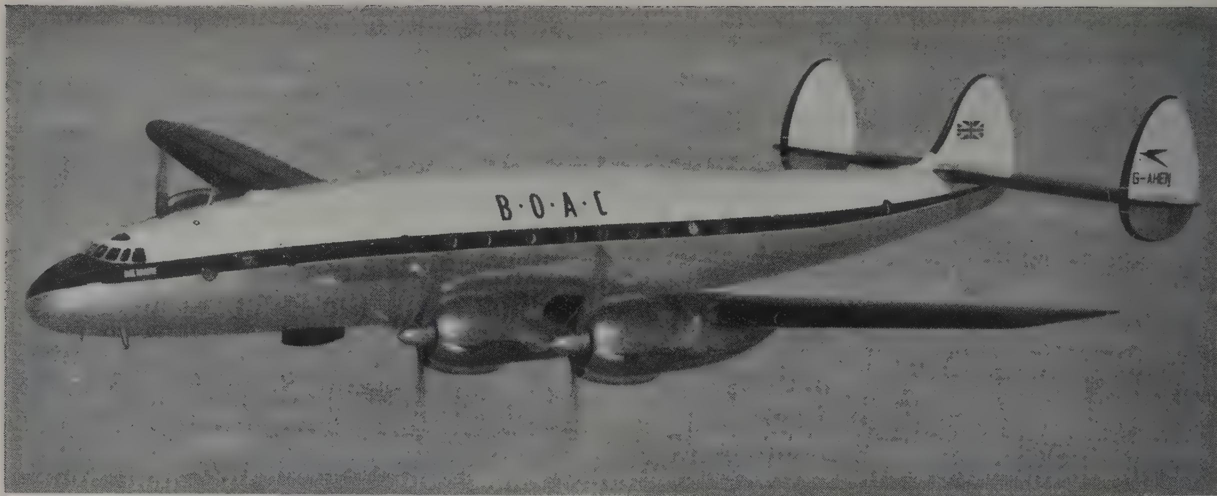
Length 95 ft. (28.9 m.).
Height 38 ft. (11.6 m.).
Weight.—
Designed A.U.W. 108,000 lb. (45,000 kg.).

THE LOCKHEED ELECTRA.

The Electra is a turboprop-powered airliner, thirty-five of which have been ordered off the drawing-board by American Airlines. Delivery will begin in the latter part of 1958 and all thirty-five are due to be delivered by the middle of 1959.

The original design of the Electra provides for the use of four 3,750 s.h.p. Allison Model 501 (military designation

A drawing of the Lockheed Electra four-turboprop Airliner.



A Lockheed Model 749 Constellation in the colours of the British Overseas Airways Corporation.

T56) turboprop engines, but at the time of writing no decision had been arrived at regarding the type of power-plant to be installed in the production aircraft, which will be designed for the use of engines developing up to 5,000 e.s.h.p. each.

The Electra for American Airlines will have first-class accommodation for 64 passengers, but a high-density version seating up to 90 tourist passengers is envisaged. Either model will be able to carry up to 4,000 lb. (1,816 kg.) of air freight, express and mail in addition to the normal amount of passenger's baggage.

The cabin will be pressurised to a cabin pressure equivalent of 8,000 ft. (2,440 m.) at 30,000 ft. (9,150 m.). Passenger loading steps will be integral and fold into the fuselage walls when not in use.

Standard equipment will include auto-pilot, weather-avoidance radar and reversible-pitch airscrews. Control systems will be of the aerodynamically-boosted mechanical type. The fuel capacity will be 4,178 U.S. gallons (15,780 litres).

The Electra will be designed to cruise at over 400 m.p.h. (640 km.h.) at up to 30,000 ft. (9,150 m.). The designed range will be 1,850 miles (2,950 km.) with a 50 m.p.h. (80 km.h.) headwind and fuel reserves for more than 2 hours.

DIMENSIONS.—
- Span 95 ft. (28.97 m.).
- Length 101 ft. 4 in. (30.90 m.).
- Height 34 ft. (10.37 m.).

WEIGHT (Estimated).—
- Loaded weight (with max. fuel) 98,500 lb. (44,680 kg.).

THE LOCKHEED CONSTELLATION AND SUPER CONSTELLATION.

U.S. Air Force designations: C-121 and RC-121.

U.S. Navy designations: R7V and WV.

The design of the original Model 49 Constellation was begun in June, 1939, to the requirements of Transcontinental & Western Air, Inc. During its development, and after consultation with T.W.A., Pan American Airways also ordered a number of Constellations but on the entry of the United States into the war both companies waived their rights in favour of the Army Air Forces, to whose requirements the Constellation was completed. The first Constellation to fly on January 9, 1943, was a C-69 military transport. The first Constellation to be built throughout as a commercial aeroplane was completed in 1947.

The following are the various currently-used and production versions of the civil and military Constellation :—

Model 49. First commercial version. Built from components of C-69 military Constellations cancelled on VJ-Day and modified for civil airline use. ATC No. 763 granted by C.A.B. on December 11, 1945. Gross take-off weight 96,000 lbs. (43,585 kg.). Landing weight 83,000 lbs. (37,680 kg.). Total fuel capacity 4,690 U.S. gallons (17,130 litres).

Model 149. This was the Model 49 with the outer wings of the Model 749. Total fuel capacity 5,820 U.S. gallons (22,000 litres). Gross take-off weight 100,000 lb. (45,400 kg.).

Model 649A. First Constellation built throughout as a commercial type. Four Wright Cyclone 749C18BD1 engines direct fuel-injection. Total fuel capacity 4,690 U.S. gallons (17,130 litres). More luxuriously furnished and has slightly greater maximum and cruising speeds. Gross take-off weight increased to 98,000 lbs. (44,490 kg.). Landing weight 89,500 lbs. (40,630 kg.). The Speedpak was first used in this model.

Model 749. Long-range version of the 649. Additional fuel tank (565 U.S. gallons=2,135 litres) in each outer wing, to raise total fuel capacity to 5,820 U.S. gallons (22,000 litres). Range increased by 1,000 miles (1,600 km.) while carrying the same payload as the 649. Gross take-off weight 102,000 lb. (46,310 kg.). Landing weight 84,500 lb. (38,363 kg.).

Model 749A. Max. take-off weight 107,000 lb. (48,580 kg.), permitting use of Speedpak at any load factors up to range of 2,200 miles (4,520 km.). Fuel capacity 5,820 U.S. gallons (22,000 litres). Maximum landing weight 89,500 lb. (40,633 kg.).

Model 1049. First Super Constellation. Fuselage lengthened by 18.4 ft. (5.6 m.). Four 2,700 h.p. Wright Cyclone 956C18 CA1 or CB1 engines. Fuel capacity 6,550 U.S. gallons (24,760 litres). Gross take-off weight 120,000 lb. (54,480 kg.). Landing weight 98,500 lb. (44,720 kg.). Carries up to 92 passengers. Cruising speed 320 m.p.h. (512 km.h.). Fourteen were delivered to Eastern Air Lines and

A Lockheed Model 1049C Super Constellation of Pakistan International Airlines.

A Lockheed Model 1049G Super Constellation of the Deutsche Lufthansa.

ten to Trans World Airlines in 1952. First prototype, a conversion of the original C-69 prototype, flew for the first time on October 13, 1950.

Model 1049C. This is the 1049 fitted with four Wright R-3350-DA1 Turbo Compound engines. First to incorporate Lockheed-Dreyfuss interior, the convertibility features of which make possible a 47-seat "siesta" version, a 59-63 passenger luxury version or a 94-seat tourist version. On domestic versions the compartment needed for extra crew on trans-Atlantic flights may be used for passengers so that capacities are slightly higher; up to 99 in tourist version. Gross take-off weight 133,000 lb. (60,380 kg.). Maximum landing weight 110,000 lb. (49,940 kg.). First Model 1049C flew for first time on February 17, 1953.

Model 1049D. Commercial cargo transport version of 1049 fitted with four 3,250 h.p. Wright R-3350-DA1 Turbo Compound engines. Has total usable cargo volume of 5,568 cub. ft. (156 m.³) and a capacity for 36,200 lb. (16,435 kg.) of payload. Two large cargo loading doors, aft door 9 ft. 4½ in. × 6 ft. 2½ in. (2.85 m. × 1.89 m.), forward door 5 ft. 1½ in. × 6 ft. 4¾ in. (1.56 m. × 1.94 m.). Maximum T.O. weight 133,000 lb. (60,380 kg.). Maximum landing weight 110,000 lb. (49,940 kg.). Four in service with Seaboard and Western Airlines.

Model 1049E. Improved version of 1049C with same maximum take-off weight but with addition of all structural modifications (except to landing gear) to permit increase of maximum take-off weight to 150,000 lb. (68,100 kg.) when engines of higher power become available.

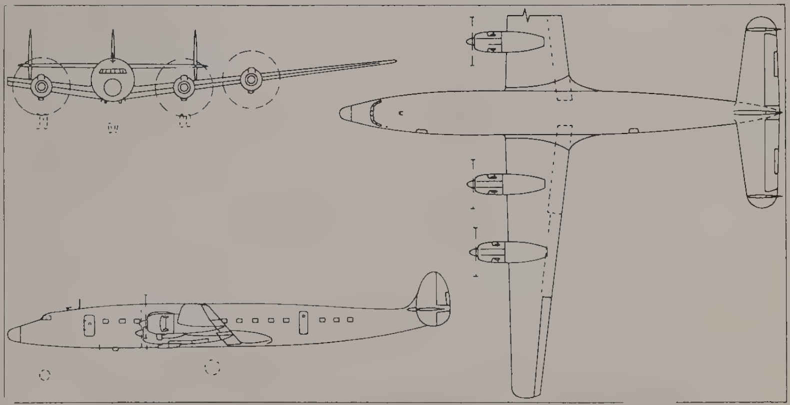
Model 1049G. Four 3,250 h.p. Wright R-3350-DA3 Turbo Compound engines Can be fitted with wing-tip auxiliary tanks (600 U.S. gallons each) raising total maximum fuel capacity to 7,750 U.S. gallons (29,340 litres). Normal range (with reserves) 4,620 miles (7,440 km.), absolute range 5,840 miles (9,400 km.). Maximum gross take-off weight 137,500 lbs. (62,425 kg.). Maximum permissible landing weight 113,000 lb. (51,300 kg.).

The following airlines have ordered Model 1049C, Model 1049E or 1049G Super-Constellations :—K.L.M. 17, Air France 20, Pakistan International 3, Qantas Empire Airways 12, Trans-Canada Air Lines 8, Air India International 5, Eastern Air Lines 16, Iberia Lineas Aereas Espanolas 3, Avianca 4, Linea Aeropostal Venezolana 3, VARIG (Brazil) 3, Thai Airways 2, Cia. Cubana de Aviacion 3, Transportes Aereos Portugueses 3, Trans World Airlines 20, Northwest Airlines 4, and the Deutsche Lufthansa 8.

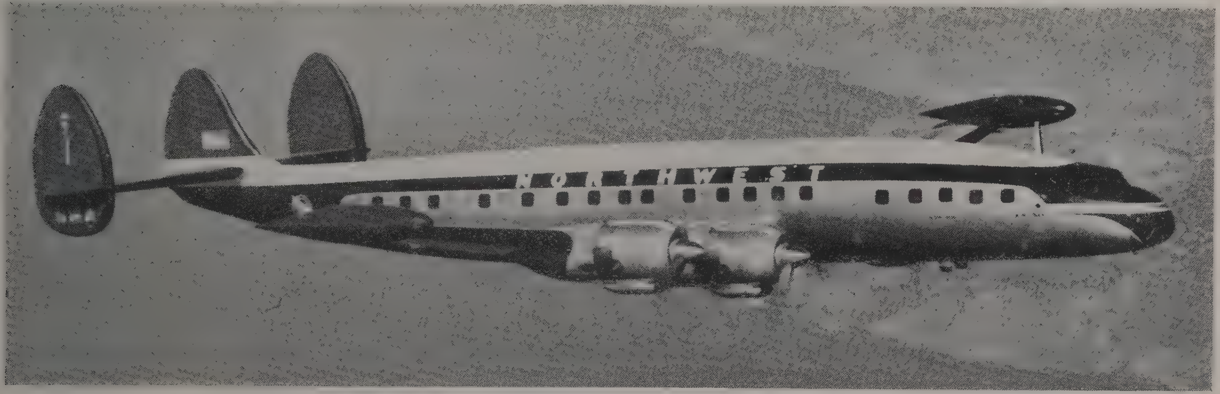
Model 1249A. Super Constellation powered by four Pratt & Whitney T34 turboprop engines. Freighter version of 1249B below.

Model 1249B. Model 1049E with four Pratt & Whitney T34 turboprop engines.

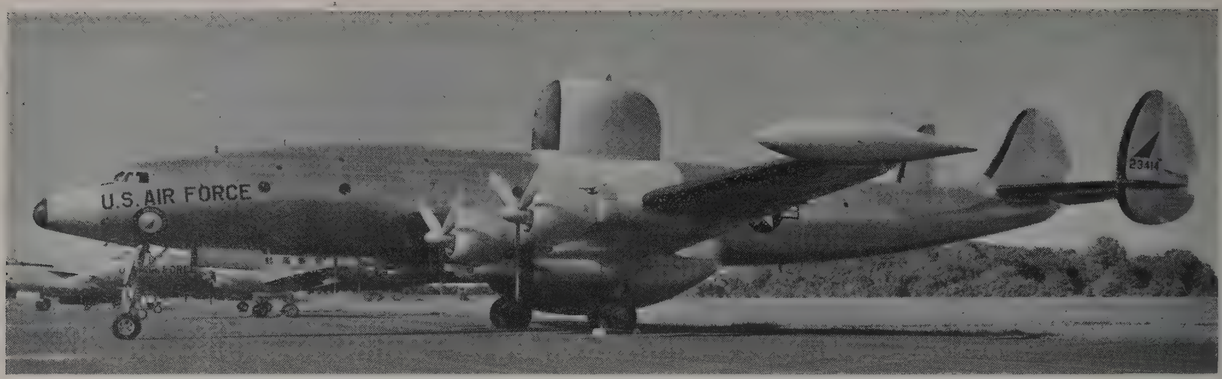
Model 1649A. Four 3,400 h.p. Wright Turbo Compound engines. Generally similar to Model 1049G, but fitted with new thin-section wings which increase span by 27 ft. (8.23 m.) and total area by 206 sq. ft. (19.11 m.²). Will have maximum range of 6,500 miles (10,400 km.), a maximum speed of 400 m.p.h. (640 km.h.) and a cruising speed of over 340 m.p.h. (544 km.h.). Twenty ordered by



The Lockheed Model 1649A Super Constellation.



A Lockheed Model 1049G Super Constellation in the colours of Northwest Orient Airlines.



The Lockheed RC-121D Early Warning Radar and Reconnaissance Monoplane. (*Olsen-Bodie*).

T.W.A. with deliveries beginning in Spring of 1957.

There are also ten military and naval versions of the Constellation and Super Constellation, brief details of which are given hereafter.

C-121A. Military long-range personnel and cargo version of the Model 749.

VC-121B. Military long-range V.V.I.P. transport version of the Model 749.

C-121C. Military long-range transport version of the Model 1049B

RC-121C. U.S.A.F. version of WV-2 early-warning radar and reconnaissance aircraft. Total fuel capacity 6,550 U.S. gallons. See WV-2 below.

RC-121D. Developed version of RC-121C. Additional fuel in two wing-tip tanks (600 U.S. gallons each) and one fuselage tank (1,000 U.S. gallons). Total fuel capacity 8,750 U.S. gallons, sufficient for endurance of 24 hours.

YC-121F. Four 5,700 h.p. Pratt & Whitney T34-P-6 turboprop engines. Two ordered by U.S.A.F. Similar to Navy R7V-2. Has capacity for 106 passengers, 18 short tons of cargo or 73 stretcher cases. A.U.W. 150,000 lb. (68,100 kg.), landing weight 113,000 lb. (51,300 kg.). Fuel capacity (including tip tanks) 8,750 U.S. gallons (33,075 litres). Designed range 3,000 miles (4,800 km.), with reserves, carrying 20,000 lb. (9,080 kg.) payload. Absolute range, no reserves, 4,000 miles (6,400 km.). First YC-121F made its first flight on April 5, 1955.

WV-1. Modified 749 to test advanced electronic systems. Two ordered by U.S. Navy. First flew on June 9, 1949.

WV-2. Production version of WV-1 to serve as a high-altitude reconnaissance and early-warning radar intelligence aircraft. Developed from Super Constellation and powered by four 3,250 h.p. Wright Turbo Compound engines. Equipped with some five and a half tons of radar and electronics, including G.E. height-finding radar in upper fuselage radome 7 ft. (2.13 m.) high, and G.E. surveillance or distance-measuring radar in the huge under-fuselage radome. Five radar consoles and plotting tables permit observation of various presentations or segments of the same basic radar picture and work on a variety of search and interception problems. Auxiliary radar units provide specialised presentations. CIC (Combat Information Center) co-ordinates all search information for communication to ships, bases or other aircraft. Navigational equipment includes storm-warning radar, Loran, etc. Equipped with bunks, galley, repair shop and all facilities for long missions. Provision for a crew of up to 31, including relief pilots, radar operators, technicians and maintenance specialists.

R7V-1. U.S. Navy transport version of the Model 1049B with four Wright R-3350-34W Turbo Compound engines. Carries up to 106 passengers in backward facing 20G removable seats, up to 19 short tons of cargo, or 73 casualties on stretchers. A.U.W. 133,000 lb. (60,380 kg.). Large loading doors fore and aft of wings.

R7V-2 (formerly R7O-2). Two aircraft powered by four 5,550 h.p. Pratt & Whitney T34 turboprop engines for evaluation of this type of power-plant for transport aircraft. Fitted with two 600 U.S. gallon wing-tip tanks, with provision for two additional 500 U.S. gallon under-wing tanks, to give a total maximum fuel capacity of 8,750 U.S. gallons. First R7V-2 flew on September 1, 1954.

The following description applies mainly to the civil Model 1049C. The structural description applies generally to all versions of the Super Constellation.

Type.—Four-engined Airliner.

Wings.—Cantilever low-wing monoplane. All-metal structure in seven main sections consisting of centre-section, two inner wings carrying engine nacelles, two outer wings and detachable tips. Two-spar structure with flush-riveted stressed metal skin. All-metal ailerons each have controllable trim-tab and hydraulic boost control. Lockheed-Fowler trailing-edge flaps extend from ailerons nearly to centre-line of fuselage. Gross wing area 1,650 sq. ft. (153.5 m.^{2}).

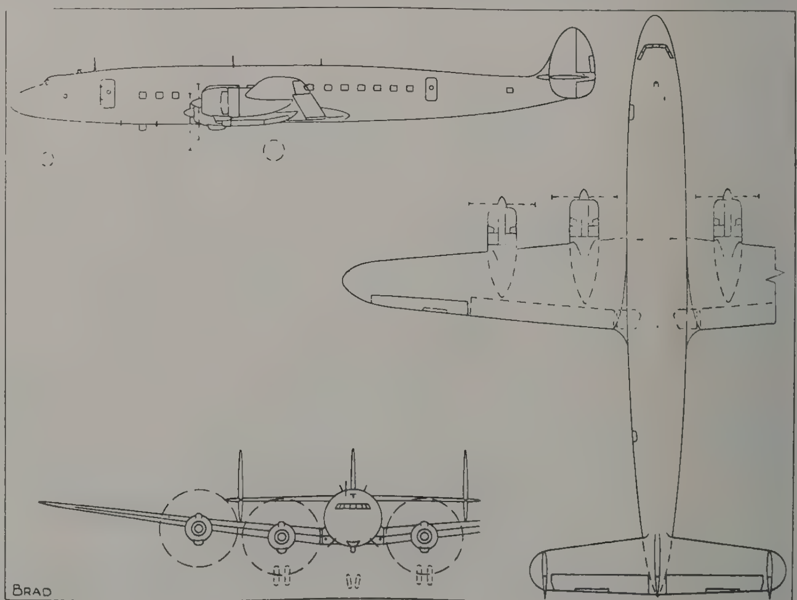
Fuselage. — All-metal semi-monocoque structure. Circular cross-section throughout length and with centre-line cambered for aerodynamic cleanliness.

Tail Unit.—Cantilever monoplane type, consisting of tailplane and two-piece elevator mounted at top of fuselage, and two inset fins and rudders with third fin and rudder on fuselage centre-line. All-metal structure with stressed metal skin on fins, tailplane and elevators. Metal-framed fabric-covered rudders. Controllable trim-tabs in rudders and elevators. Hydraulically-boosted control surfaces with manual override control for auxiliary use. Tailplane span 50 ft. 0 in. (15.24 m.).

Landing Gear.—Retractable tricycle type with dual wheels on all units. Dual hydraulic brake system on main wheels with manual auxiliary override control. Track (centre-line of legs) 28 ft. 0 in. (8.50 m.).

Power Plant.—Four Wright R-3350-DA1 Turbo Compound eighteen-cylinder two-row radial air-cooled engines each rated at 3,250 h.p. for take-off. Stainless-steel nacelles, with all ducting and controls grouped at fire-proof bulkhead, are completely detachable and can be changed in 30 minutes. Automatic fire-detection and location with positive fire-extinguisher system operated by flight engineer. Hamilton Standard or Curtiss three-blade reversible airscrews, 15 ft. 2 in. (4.62 m.) diameter. Seven separate fuel systems in wings with total capacity of 6,550 U.S. gallons (24,760 litres). Total oil capacity 227 U.S. gallons (858 litres) in five separate tanks.

Accommodation.—Pressurized cabin for crew and passengers maintains 8,000 ft. (2,440 m.) cabin atmosphere at 22,800 ft. (6,955 m.). Two fully-automatic cabin superchargers with manual override control. Thermostatically-controlled heating and cooling. Refrigeration unit cools cabin to 80 degrees Fahrenheit with outside temperature at 99 degrees Fahrenheit. Pilot's compartment in forward portion of fuselage with pilot (on port) and co-pilot side-by-side with dual controls. Flight engineer behind co-pilot facing outboard. Radio-operator behind pilot. Two cabin attendants. Entry to crew compartment on starboard side. Aft of crew compartment is a section which may be used as a galley, buffet, etc. Next follows main passenger cabin, insulated against sound, vibration and outside temperature. Many alternative arrangements allow for total accommodation up to 94 passengers. Two passenger doors



The Lockheed Model 1049 Super Constellation.

and one separate crew door. Two freight compartments with total capacity of 728 cub. ft. (20.6 m.^{3}) below floor of main cabin. Other freight stowage dependent on passenger accommodation. On Models 649 and 749 additional freight, etc., can be carried in an all-metal pannier, known as a "Speedpak," 33 ft. long × 7 ft. wide × 3 ft. deep (10.05 × 2.13 × 0.9 m.) and weighing 1,800 lb. (817 kg.). This is carried under and closely fits the contour of fuselage. The "Speedpak" has capacity of 400 cub. ft. (11.32 m.^{3}) and a stowage allowance of 8,200 lb. (3,723 kg.). Built-in electric hoists lowers "Speedpak" to ground for loading or unloading. "Speedpak" reduces speed by about 12 m.p.h. (19.2 km.h.).

DIMENSIONS.—
Span 123 ft. 0 in. (37.49 m.).
Length 113 ft. 7 in. (34.65 m.).
Height over fuselage 18 ft. 10 in. (5.73 m.).
Height overall 24 ft. 9 in. (7.56 m.).

WEIGHTS (Model 1049E).—
Max. take-off loaded weight 133,000 lb. (60,380 kg.).
Max. landing weight 110,000 lb. (49,940 kg.).

PERFORMANCE (Model 1049E).—
Max. speed (fully loaded) 352 m.p.h. (563 km.h.) at 10,500 ft. (3,200 m.).
Max. speed (at max. landing weight) 376 m.p.h. (602 km.h.) at 20,000 ft. (6,050 m.).
Max. cruising speed at 75% power, 331 m.p.h. (530 km.h.) at 23,000 ft. (7,015 m.).
Landing speed 99.5 m.p.h. (159 km.h.).
Initial rate of climb (at max. A.U.W. at S/L.) 1,140 ft./min. (348 m./min.).
Initial rate of climb (at max. A.U.W. at S/L.) one engine inoperative 640 ft./min. (195 m./min.).
Max. range (full fuel, no reserve) at 10,000 ft. (3,050 m.) 4,820 miles (7,710 km.).
Take-off distance to clear 50 ft. (15 m.) with full load, 4,600 ft. (1,403 m.).
Landing distance from 50 ft. (15 m.) at max. landing weight 3,550 ft. (1,083 m.).

THE LOCKHEED XFV-1.

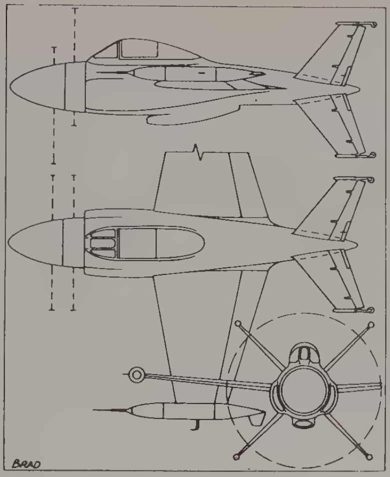
The XFV-1 is an experimental single-seat fighter which has been designed for vertical take-off and landing, while capable of conventional horizontal flight at about 500 m.p.h. (800 km.h.).

The XFV-1, which is a straight-wing mid-wing monoplane, has a cruciform tail-unit at the extremities of which are four sprung swivelling castor-wheel units from which it takes off and on which it lands vertically.

The power-plant consists of a 5,850 s.h.p. Allison T40 turboprop engine which drives two 16-foot (4.88 m.) diameter Curtiss-Wright Turboelectric co-axial contra-rotating airscrews.

A special ground-handling trolley is used for translating the XFV-1 from the horizontal to its vertical position and vice-versa. A mobile access ladder is also necessary to enable the pilot to gain access to the cockpit, in which the seat is gimbal-mounted so that the pilot will be in a semi-upright position for vertical flight.

A conventional landing-gear was pro-



The Lockheed XFV-1.

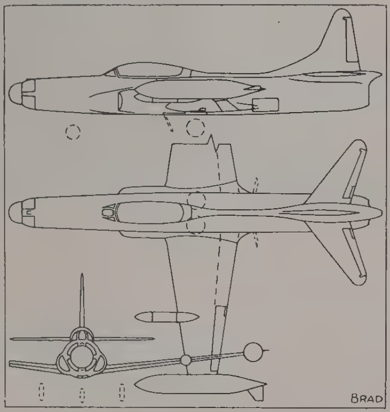
vided for horizontal take-offs and landings during the early tests.

The XFV-1 has never taken off vertically and it is understood that the U.S. Navy has cancelled its contract and that further development has been abandoned.

THE LOCKHEED XF-104.

The XF-104, the first prototype of which flew for the first time in February, 1954, is categorised as an "air superiority" jet fighter and has been designed to attain supersonic speeds in combat. Although relatively small by comparison with current U.S. jet fighters it is not appreciably lighter than the F-86, weighing according to unofficial reports about 15,000 to 16,000 lb. (6,810 to 7,265 kg.).

The XF-104 has a thin straight wing with a span of about 28 ft. (8.53 m.) and is powered by a Wright J65-W-6 engine with afterburner.



The Lockheed F-94C Starfire.

No further details, nor any photographs, had been released for publication at the time of closing for press.

THE LOCKHEED STARFIRE.
U.S.A.F. designation: F-94.

The F-94 two-seat All-weather Fighter is a development of the F-80 Shooting Star. It was evolved from the two-seat T-33 trainer and originally used many of the main components and the production facilities of its predecessor. Later versions incorporate much original development.

The structure of the F-94 is generally similar to that of the F-80.

F-94A. Allison J33-A-33 turbojet engine with Solar afterburner. Two-seat All-weather Fighter version of T-33 with radar operator replacing pupil pilot in second tandem seat, plus 940 lb. (426 kg.) of radar equipment. Wings, landing-gear and centre fuselage same as for T-33. New nose and rear fuselage sections, former to house radar, latter to accommodate after-burner installation. All hydraulic electric and control systems similar to those of the F-80C. The prototype was a converted T-33.

F-94B. Development of F-94A with improved electronic and operational equipment. Square wing-tips with centrally-mounted Fletcher tip tanks of greater capacity (230 U.S. gals. = 870 litres each) and improved shape.

F-94C. Pratt & Whitney J48-P-5 engine with afterburner (6,250 lb. = 2,840 kg. s.t. without afterburner). Thinner wings, longer nose, swept horizontal tail surfaces and larger vertical surfaces. All-rocket armament comprising 48 × 2.75 in. rockets, 24 housed in a ring of firing tubes around the nose, and a further 24 rockets in two cylindrical pods, one on each wing midway between root and tip. Fiberglass noses to pods disintegrate in split second before rockets leave container by gas pressure generated by rockets themselves. The 9 ft. 6 in. (2.89 m.) pods extend about 6 ft. (1.83 m.) from wing leading-edge. 1,200 lb. of electronic equipment, including automatic locating, tracking and firing instruments, Westinghouse auto-pilot, Sperry Zero-Reader, ILS, etc.

DIMENSIONS (F-94C).—
Span 37 ft. 4 in. (11.38 m.).
Length 44 ft. 6 in. (13.57 m.).
Height 14 ft. 11 in. (4.54 m.).

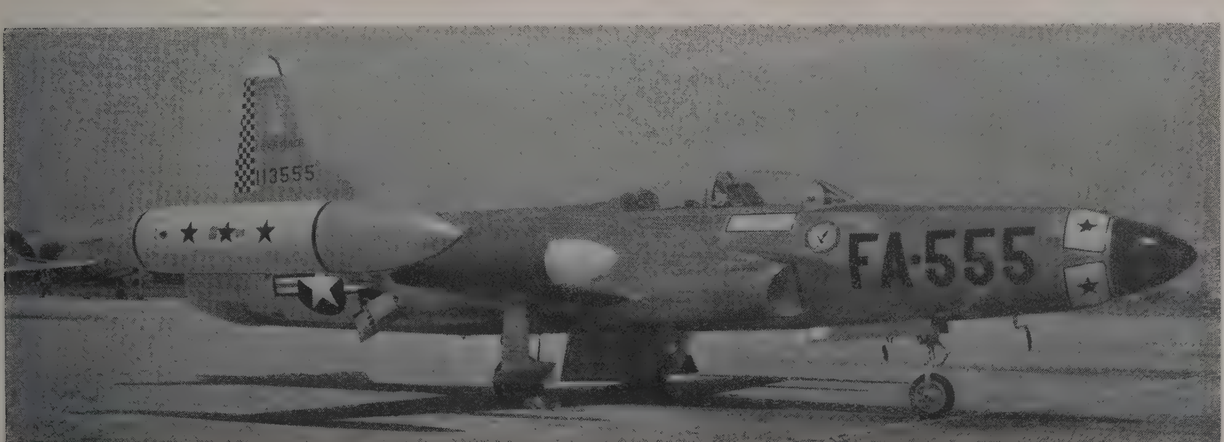
WEIGHT (F-94B).—
Weight loaded over 15,000 lb. (6,810 kg.).

WEIGHT (F-94C).—
Weight loaded over 20,000 lb. (9,080 kg.).

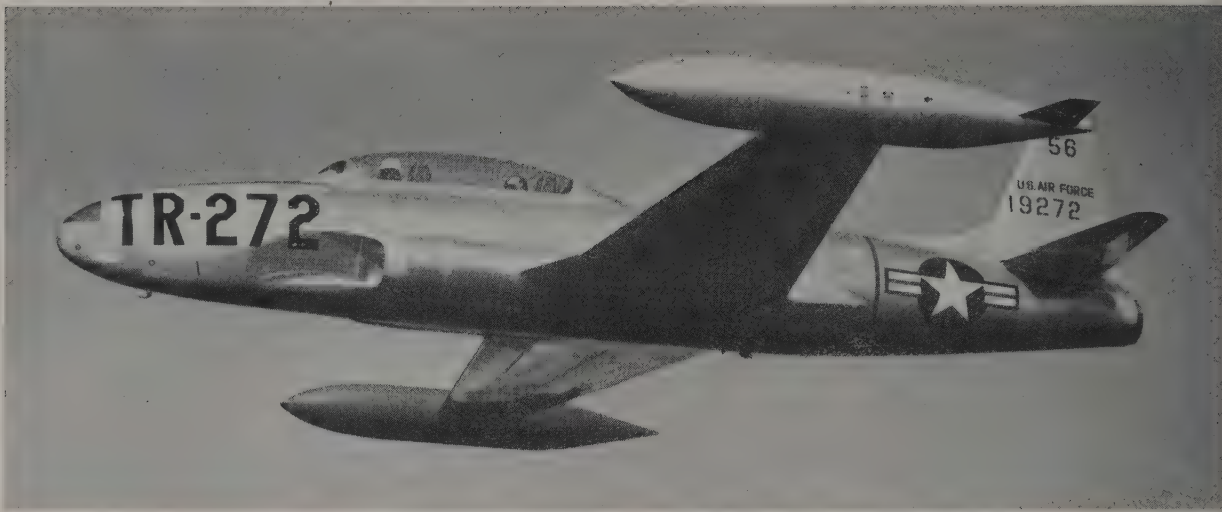
PERFORMANCE.—
No data available.

THE LOCKHEED SHOOTING STAR.
U.S. Air Force designations: F-80 and T-33.
U.S. Navy designation: TV.

The only version of the Shooting Star in production is the two-seat trainer, which



The Lockheed F-94C Starfire All-weather Fighter (Allison J33 turbojet engine). (*Olsen-Bodie*).



The Lockheed T-33A Shooting Star Two-seat Trainer (Allison J33 turbojet engine).

is the standard jet trainer in service in the U.S.A.F., U.S. Navy, U.S. Marine Corps and has been supplied to the air forces of twelve M.D.A.P. nations. It has also been bought by four Latin-American powers—Cuba, Colombia, Peru and Venezuela.

Current orders for the T-33 will keep it in production into late 1956.

The following are the current versions of the trainer :—

T-33A. Allison J33-A-35 engine (5,200 lb.=2,360 kg. s.t.). Fuselage lengthened by 38.6 in. (98.1 cm.), 26.6 in. forward of wings and 12 in. aft, to accommodate extra seat. Both seats under a continuous canopy hinged at rear edge and raised electrically or manually from either inside or outside aircraft. Smaller fuselage fuel tank (95 U.S. gallons=360 litres) and larger wing tanks, which are nylon cells instead of self-sealing type. Instructor in rear seat. Armament: two .50-in. machine-guns. Built under licence by Canadair, Ltd. Canadian production aircraft powered by Rolls-Royce Nene engines.

RT-33A. Single-seat photographic reconnaissance version of the T-33. Carries a battery of four mapping and charting cameras and a wire recorder, to enable the pilot to make a record of the flight over the target to elaborate on particular features of the terrain and to record height and position. Operational range of the RT-33 is said to be approximately 20 per cent. greater than that of the standard two-seat T-33.

TV-2. U.S. Navy version of the T-33A two-seat trainer.

The nose of the Lockheed RT-33A Photographic Reconnaissance Monoplane.

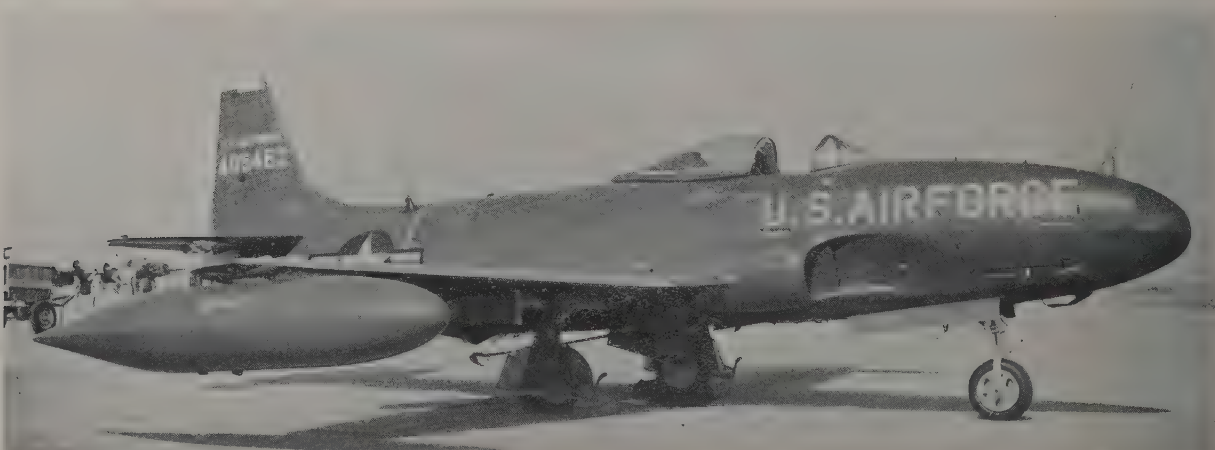
A full structural description of the Shooting Star has appeared in previous editions of "All the World's Aircraft."

Versions of the F-80 Shooting Star are still in service in various forms, one of which, the QF-80A Target Drone, is shown in the illustration below.

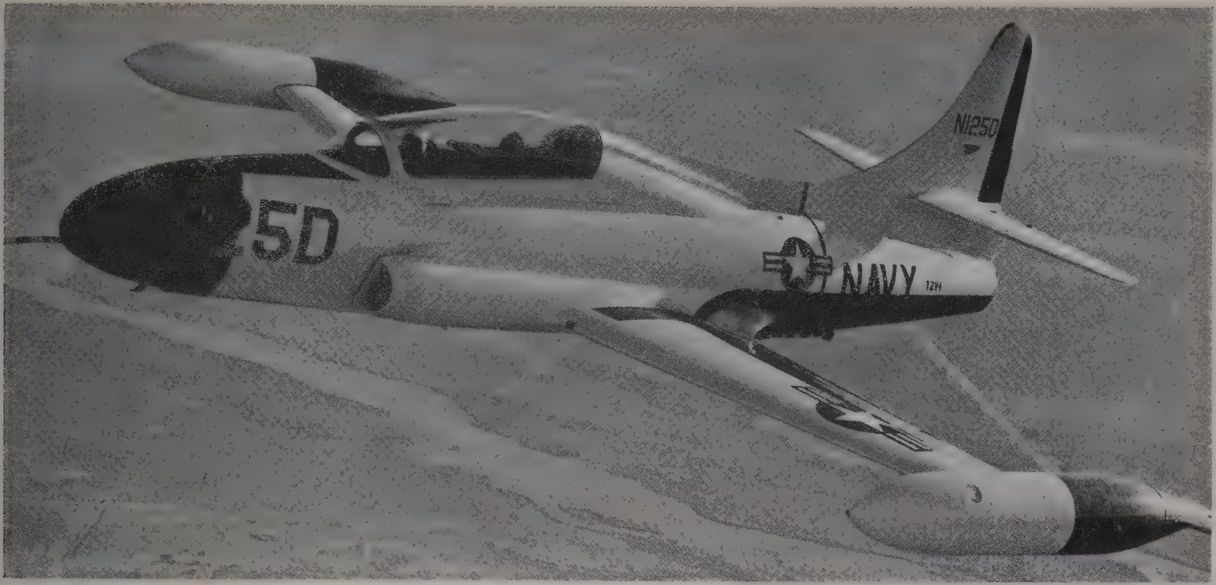
Dimensions (T-33A).—
Span 38 ft. 10½ in. (11.85 m.).
Length 37 ft. 9 in. (11.49 m.).
Height 11 ft. 4 in. (3.45 m.).

Weights (T-33A).—
Weight empty 8,084 lb. (3,670 kg.).
Weight loaded 11,965 lb. (5,432 kg.).

Performance (T-33A).—
Max. speed at S/L. 600 m.p.h. (960 km.h.).
Max. speed at 25,000 ft. (7,620 m.) 543 m.p.h. (874 km.h.).
Stalling speed (with flaps) 102 m.p.h. (164 km.h.).



The Lockheed QF-80A Radio-controlled Target Drone. Note the radio aerials and arrester hook. (*G. S. Williams*).



The Lockheed T2V-1 "Sea Duty" Trainer (Allison J33 turbojet engine).

Stalling speed (without flaps) 113 m.p.h. (182 km.h.).
Climb to 25,000 ft. (7,620 m.) 6.5 min.
Service ceiling 47,500 ft. (14,480 m.).
T.O. distance to 50 ft. (15.25 m.) (with water injection) 2,560 ft. (780 m.).
Landing distance from 50 ft. (15.25 m.) 3,480 ft. (1,061 m.).
Endurance 3.12 hours.

THE LOCKHEED MODEL 245.

U.S. Navy designation: T2V-1.

The Model 245, developed from the T-33 as a "private venture" two-seat all-purpose jet trainer, has been adopted by the U.S. Navy in modified form as a "sea duty" trainer. As the T2V-1, it is the first U.S. aeroplane to be ordered into production with boundary-layer control as standard equipment, and will be the first jet trainer to be assigned to pilot training operations in sea-going carriers as well as from land bases.

Type.—Two-seat Naval "Sea Duty" Jet Trainer.

Wings.—Low-wing cantilever monoplane. All-metal structure similar to that of T-33 Shooting Star but fitted with movable leading-edge slats and boundary-layer control. Compressed air tapped from engine is ducted in tubes along trailing-edges and blown at high speed through slots in tubes over upper surfaces of flaps and ailerons to increase lift and delay approach to stall.

Fuselage.—Light-alloy semi-monocoque structure.

Tail Unit.—Cantilever monoplane type. All-metal structure similar to that of T-33 but tailplane raised 20 in. (50.8 cm.) to position on fin, the span increased by 12 in. (30.5 cm.) and dorsal fin extension added.

Landing Gear.—Retractable nose-wheel type. Similar in general to that of T-33 but strengthened to absorb four times more energy on landings and take-offs. Nose-wheel strut can be hydraulically lengthened when in extended position to raise nose of aircraft for faster climbs on carrier catapult take-offs. Arrester hook under fuselage is extended hydraulically and maintained in position pneumatically.

Power Plant.—One Allison J33-A-22 turbojet engine (6,100 lb.=2,770 kg. s.t.) in production T2V-1. Alternatively Pratt & Whitney J48-P-8 (7,250 lb.=3,415 kg. s.t.) may be fitted. Fuel in fuselage tank (300 U.S. gallons=1,134 litres) and two non-jettisonable wing-tip tanks (230 U.S. gallons =870 litres each). Wing-tip fuel can be dumped in flight by ram air. Total fuel capacity 760 U.S. gallons (2,874 litres).

Accommodation.—Tandem seats with dual controls under jettisonable one-piece clam-shell type canopy. Rear (instructor's) seat 6 in. (15.2 cm.) higher than front seat. Ejector seats. Auxiliary inside windscreen of laminated aluminium in rear cockpit is raised automatically for wind-blast protection when canopy is jettisoned.

Equipment.—Navigational equipment includes radio and ADF installation, glide path receiver and VOR localizer, and BIA attitude gyro, a combination homing device and gyro compass. Two-in-one instruments on control panel which, by use of selector switches, give individual readings from two devices on one dial.

Dimensions.—
Span (over tip/tanks) 42 ft. (12.8 m.).
Length 38 ft. (11.6 m.).
Height 13 ft. (3.9 m.).

Weight Loaded.—
Approx. 16,400 lb. (7,445 kg.).

Performance.—
Max. speed over 600 m.p.h. (960 km.h.).
Landing speed 97 m.p.h. (155 km.h.).
Range about 900 miles (1,440 km.).

THE LOCKHEED MODEL 26 NEPTUNE.

U.S. Navy designation : P2V.

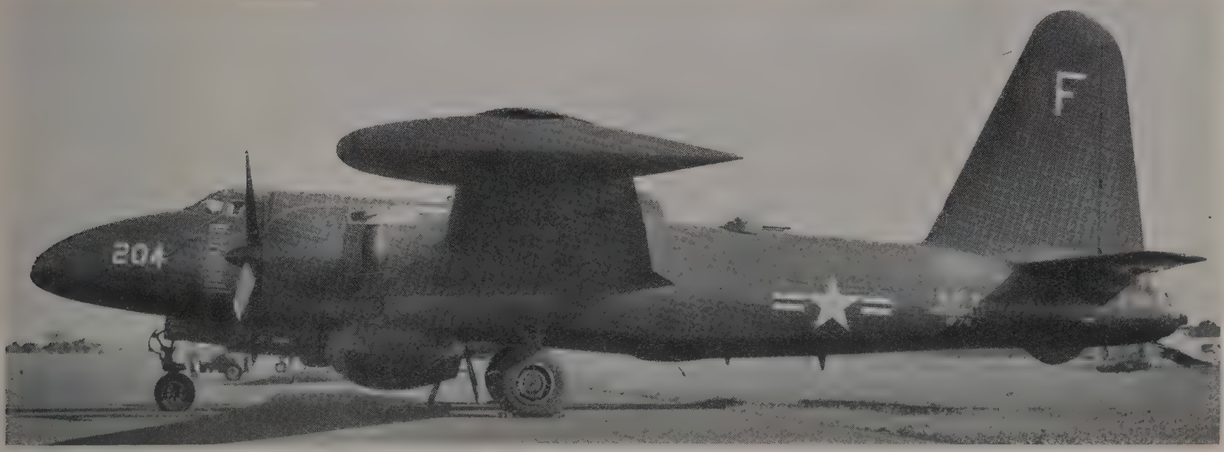
The first U.S. Navy contract for the Neptune was placed in April, 1944, for two XP2V-1's. Since then Lockheed has received one contract for the P2V-1, two for the P2V-2, two for the P2V-3, one for the P2V-4, ten for the P2V-5, three for the P2V-6 and four for the P2V-7. The current P2V-7 contract will extend production into late 1956.

In addition a contract was received in October, 1954, for the conversion of all P2V-5's and P2V-6's to P2V-7 standard with auxiliary jet power. This modification programme will require three years to complete.

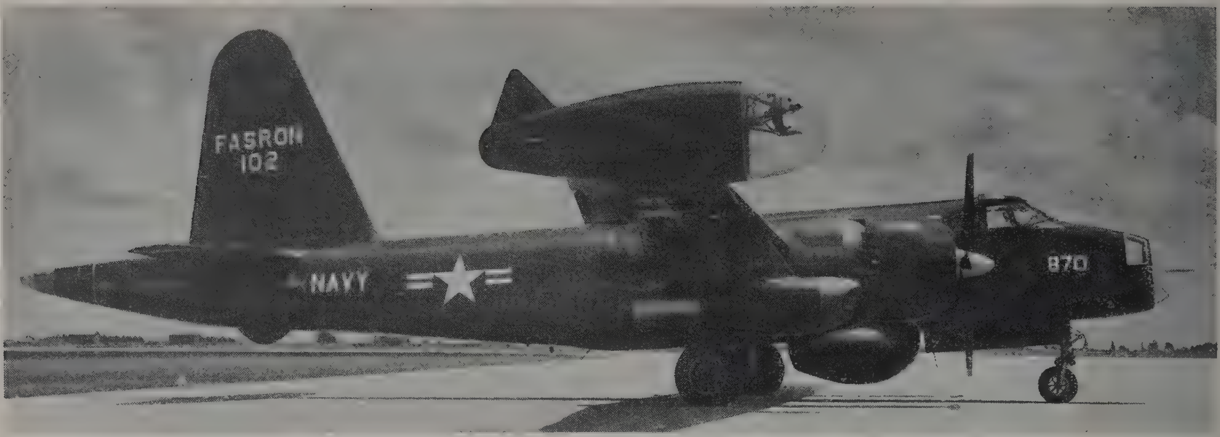
In addition to world-wide service with the U.S. Navy, the Neptune has also been supplied to the Royal Air Force, the Royal Australian Air Force, the Royal Canadian Air Force, the Royal Netherlands Air Force and the French Navy.

The principal versions of the Neptune are :—

P2V-1. Two Wright R-3350-8 engines each with normal rated power of 2,100 h.p. and with 2,300 h.p. for take-off, driving Hamilton Standard four-blade airscrews with alcohol de-icing. Short



The Lockheed P2V-4 Neptune (two Wright Turbo Compound engines). (*Gordon Williams*).



A Lockheed P2V-5 Neptune with auxiliary wing-mounted turbojet pods. (*Gordon Williams*).

nose with armament of two flexible .5-in. (12.7 mm.) machine-guns. Dorsal and tail turrets each armed with two .5-in. (12.7 mm.) guns.

Between September 29 and October 1, 1946, the third production P2V-1, suitably modified, set up a World's Record for Distance in a Straight Line by flying non-stop from Perth, Western Australia, to Columbus, Ohio, U.S.A., a distance of 11,235 miles (17,976 km.). Flight time was 55 hours 17 min.

The aircraft took off at a loaded weight of 85,000 lbs. (38,600 kg.) of which 50,400 lbs. (22,890 kg.) was gasoline, the fuel load alone representing about one and a half times the empty weight of the aircraft. Jato was used for take-off.

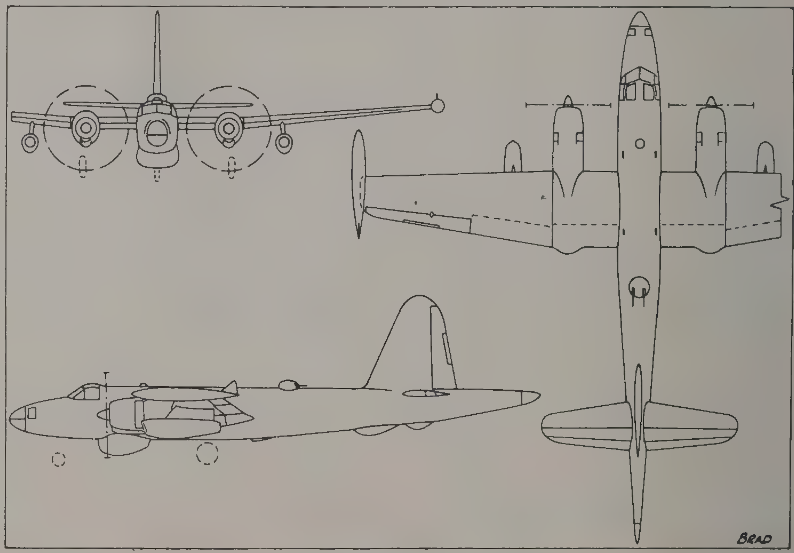
P2V-2. Two Wright R-3350-24W engines, each with take-off output of 2,500 h.p. (dry) or 2,800 h.p. (wet) and normal continuous rating of 2,100 h.p. Hamilton Standard three-blade airscrews with paddle blades and electric de-icing. Combustion type heaters for wing and tail de-icing. Longer nose (2½ ft.=0.76 m. longer than P2V-1) with additional search and tactical radar equipment. Nose armament increased to six 20 mm. cannon, fired by pilot. Dorsal turret armed with two .50-in. machine-guns and tail turret with two 20 mm. cannon. Other war stores as for P2V-1.

P2V-3. Two Wright R-3350-26WA engines each with a take-off output of 2,610 h.p. (dry) or 3,090 h.p. (wet) and a normal continuous rating of 2,300 h.p. P2V-3W is a special search and early warning radar version.

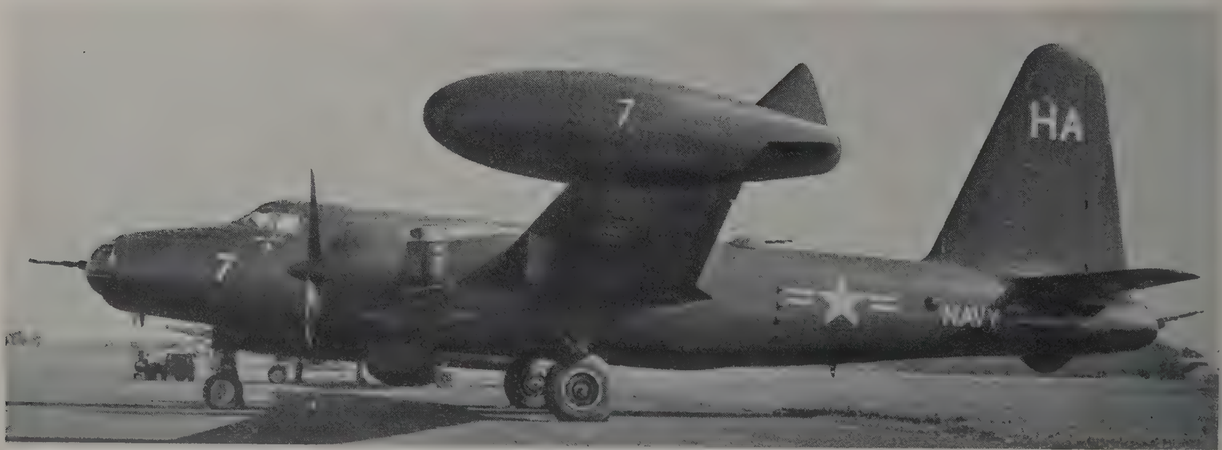
P2V-4. Two Wright R-3350-30W Turbo Compound engines each developing 3,250 h.p. for take-off (dry). Fitted with new anti-submarine detection equipment, including improved radar search apparatus with large external radome beneath fuselage, magnetic detection gear, etc. Increased wing tankage permits increased range and releases space in fuselage for additional armament and electronic devices.

P2V-5. Development of P2V-4. Has flexible nose gun turret armed with two 20 mm. cannon in place of the previous fixed nose armament. Larger wing-tip tanks carrying radar and searchlight as well as extra fuel. Considerably more internal radar and electronic equipment. First model to be fitted with elongated tail enclosing anti-submarine magnetic airborne detection (MAD) gear. All P2V-5's to be modified for installation of two Westinghouse J34 turbojet engines in wing-mounted pods as in P2V-7.

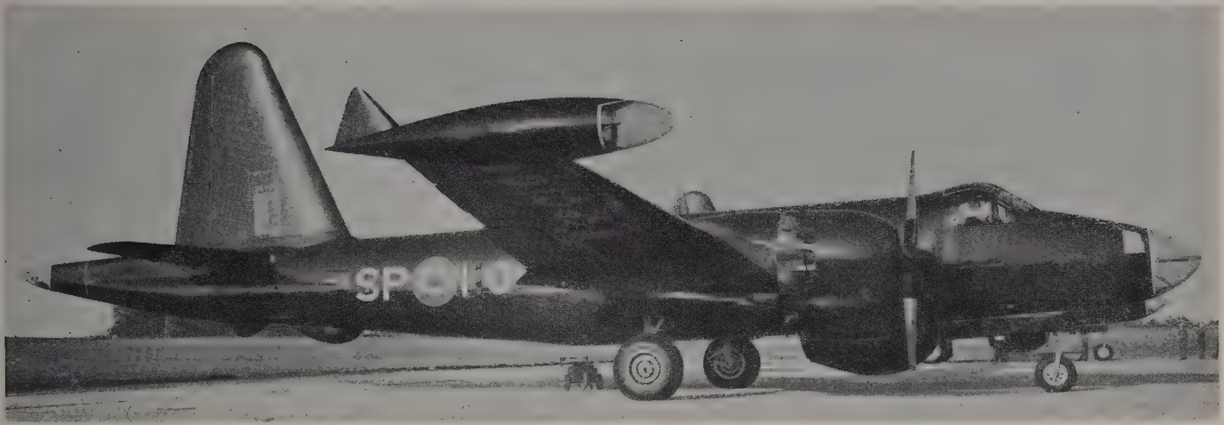
P2V-6. Similar to P2V-5 but specially equipped for mine-laying and anti-submarine warfare. Longer nose to give added room for forward crew and improved access to equipment, smaller wing-tip tanks and smaller radome. New features include stainless steel engine nacelles and pressure fuelling. Interchangeability for mine-laying and anti-submarine work permits a wide selection of armament. Appearance of P2V-6



The Lockheed P2V-7 Neptune.



A Lockheed P2V-6B Neptune, the suffix B indicating special armament. (*Gordon Williams*).



A Lockheed P2V-7 Neptune of the Royal Canadian Air Force. The Canadian P2V-7's do not have the auxiliary jet pods. (*Gordon Williams*).

will vary with different types of missions. All P2V-6's to be modified for installation of two Westinghouse J34 turbojet engines in wing-mounted pods as in P2V-7.

P2V-7. Two 3,500 Wright R-3350-32W Turbo Compound engines, plus two Westinghouse J34 turbojets (3,400 lb.= 1,540 kg. s.t. each) in wing-mounted pods outboard of engine nacelles to augment take-off and combat performance. Enlarged crew space and other interior modifications of a classified nature; bulged cockpit canopy for improved all-round view; modified nose landing-gear unit; redesigned wing-tip tanks; and simplified multifunction control systems. Like all other models, the P2V-7 can be converted for patrol, mine-laying or torpedo bomber duties.

The following description refers to the P2V-3.

Type.—Twin-engined Naval Patrol Bomber.

Wings.—All-metal cantilever mid-wing monoplane. Aerofoil section NACA 2419 modified with max. thickness at 38% of chord. Wing designed to give temporary flotation in event of ditching. Centre-section wing box continuous through fuselage and entire bomb-bay load carried directly by wing. All-metal ailerons with controllable trim-tab in each. Lockheed-Fowler flaps on circular arc racks inboard of ailerons. Max. flap depression 32°. Ailerons also droop 10° when flaps lowered. Internal aerodynamic balances on all control surfaces. Heated leading-edge de-icing. Gross wing area 1,000 sq. ft. (92.9 m.²).

Fuselage.—All-metal semi-monocoque structure.

Tail Unit.—Cantilever monoplane type, with metal covering over all surfaces. Tail-unit incorporates "Varicam" (variable camber), a movable trimming surface between fixed tail and elevator which is operated by electrically-driven irreversible screw-jack. Tail-plane and fin have detachable thermally-heated leading-edges. Vertical fin area 17% of wing area. Balanced control surfaces, with trim-tab in each elevator. Trim-balance tabs in rudder. Elevator area (each) 39.3 sq. ft. (3.65 m.²). Rudder area 38.4 sq. ft. (3.57 m.²).

Landing Gear.—Retractable tricycle type. Hydraulic brakes on main wheels.

Power Plant.—Two Wright R-3350-26WA eighteen-cylinder two-row radial air-cooled engines. Hamilton Standard Hydromatic three-blade constant-speed airscrews, 15 ft. 2 in. (4.62 m.) diameter. Self-sealing fuel-tanks with nylon plastic casing. Normal fuel capacity 2,200 U.S. gallons (8,316 litres). Provision for 700 U.S gallon (2,646 litres) ferrying tank in bomb-bay. Dural armour in nacelles.

Accommodation.—Crew of seven: pilot, co-pilot, navigator/bombardier (who handles radar bombing gear), radar operator, and dorsal and rear gunners. All positions armoured. Galley and sleeping accommodation.

Armament.—Up to six 20 mm. forward-firing cannon in nose; two .5-in. (12.7 mm.) flexible machine-guns in dorsal turret; and two flexible 20 mm. cannon in power-operated tail-turret. Provision for sixteen 5-in. (12.7 cm.) rocket projectiles under wings. Bomb-load of 8,000 lb. (3,629 kg.) carried internally may consist of sixteen 500 lb. (227 kg.), eight 1,000 lb. (454 kg.) or four 2,000 lb. (907 kg.) bombs, two 2,165 lb. (982 kg.) torpedoes, or 2,000 lb. (907 kg.) sea-mines, or twelve 325 lb. (147 kg.) depth-charges. Sonobuoy installation.

Dimensions.—
Span 100 ft. 0 in. (30.48 m.).
Length 76 ft. 10 in. (23.43 m.).
Height (over rudder) 28 ft. 1 in. (8.5 m.).

Weights (P2V-3).—
Weight empty 34,683 lb. (15,746 kg.).
Disposable load 23,317 lb. (10,586 kg.).
Max. take-off weight 58,000 lb. (26,300 kg.).
Landing weight 54,000 lb. (24,520 kg.).

Weights (P2V-7).—
Weight empty (without auxiliary jets) 43,950 lb. (19,950 kg.).
Weight empty (with jets) 47,450 lb. (21,540 kg.).
Weight loaded (without auxiliary jets) 72,000 lb. (32,670 kg.).
Weight loaded (with jets) 75,500 lb. (34,280 kg.).

Performance (P2V-3).—
Max. speed 288 m.p.h. (461 km.h.) at 12,600 ft. (3,840 m.).
Stalling speed (power on) 77 m.p.h. (123.2 km.h.).
Initial rate of climb (T.O. weight) 2,086 ft. min. (636 m./min.).
Service ceiling 27,100 ft. (8,265 m.).
Range 3,560 miles (5,696 km.) at 180 m.p.h. (288 km.h.) at 1,500 ft. (460 m.).
T.O. distance to clear 50 ft. (15.25 m.) (T.O. weight and power) 947 yds. (866 m.).

The Lockheed P2V-7 Neptune (two Wright R-3350 Turbo Compound engines, plus two Westinghouse J34 turbojet engines in underwing pods).

McDONNELL

The prototype McDonnell YF-101A Voodoo Tactical Fighter (two Pratt & Whitney J57 turbojet engines).

McDONNELL AIRCRAFT CORPORATION.

Head Office and Works: St. Louis 3, Missouri.

President and Chairman of the Board: J. S. McDonnell, Jr.

Vice-President and General Manager: R. H. Charles.

Vice-President, Manufacturing: C. Warren Drake.

Vice-President, Engineering: Kendall Perkins.

Vice-President, Airplane Engineering: G. C. Covington.

Vice-President, Personnel and Public Relations: W. R. Orthwein, Jr.

Vice-President, Sales and Service: J. F. Aldridge.

Chief Engineer, Helicopters: C. H. Hurcamp.

Chief Engineer, Missiles: B. G. Bromberg.

Factory Manager: W. F. Burke.

Secretary: Thomas G. Rutledge.

Treasurer: J. H. Cinnater.

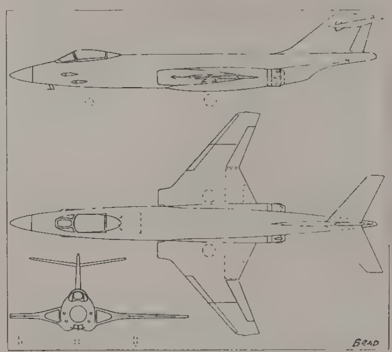
The McDonnell Aircraft Corporation was incorporated on July 6, 1939. Since that date the activities of the company have been devoted exclusively to the development and production of aircraft for the U.S. Government.

The first aircraft of McDonnell design to go into production for the U.S. Navy was the FH-1 Phantom twin-jet fighter and this was followed by the F2H-1 Banshee, which went into production in 1947. The Banshee in successively developed forms was in continuous production for six years, and a total of 800 was supplied to the U.S. Navy and Marine Corps. The last F2H-4 Banshee was delivered in October, 1953.

The latest U.S. Navy fighter of McDonnell design is the F3H Demon, a swept-wing carrier fighter, the prototype of which flew for the first time on August 7, 1951. The first production Demon was delivered to the U.S. Navy on January 8, 1954.

For the U.S. Air Force McDonnell is building the F-101A Voodoo long-range twin-jet swept-wing escort fighter.

McDonnell is also very actively engaged in rotary-wing development. In 1951 it was successful in two competitions, one for a cargo transporter or "flying crane" (XHCH-1) for the U.S. Navy, and the other for a convertiplane (XV-1) for the U.S. Army. Detailed information on these aircraft as well as on the company's work in the field of guided missiles is classified.



The McDonnell F-101A Voodoo.

THE McDONNELL VOODOO.

U.S. Air Force designation: F-101A.

The original XF-88 and XF-88A swept-wing twin-jet fighters, the latter with afterburners, underwent successful evaluation by the U.S.A.F. in 1949 and 1950, but owing to a cut-back in defense funds and a change in tactical requirements, the experimental contract was terminated in August, 1950.

After a period of over a year the XF-88A was revived and, with modifications, has now been ordered into production as a long-range escort fighter under the designation F-101A. A photographic-reconnaissance version has also been ordered. Both will be powered by two Pratt & Whitney J57-P-13 turbojet engines (10,000 lb.=4,540 kg. s.t. each).

The first F-101A flew on September 29, 1954 and this aircraft exceeded Mach. 1 on its first flight.

The production F-101A will be assigned to the U.S.A.F. Strategic Air Command as a long-range fighter. The F-101A is in the supersonic class, is capable of carrying atomic weapons, and is fitted with in-flight refuelling equipment.

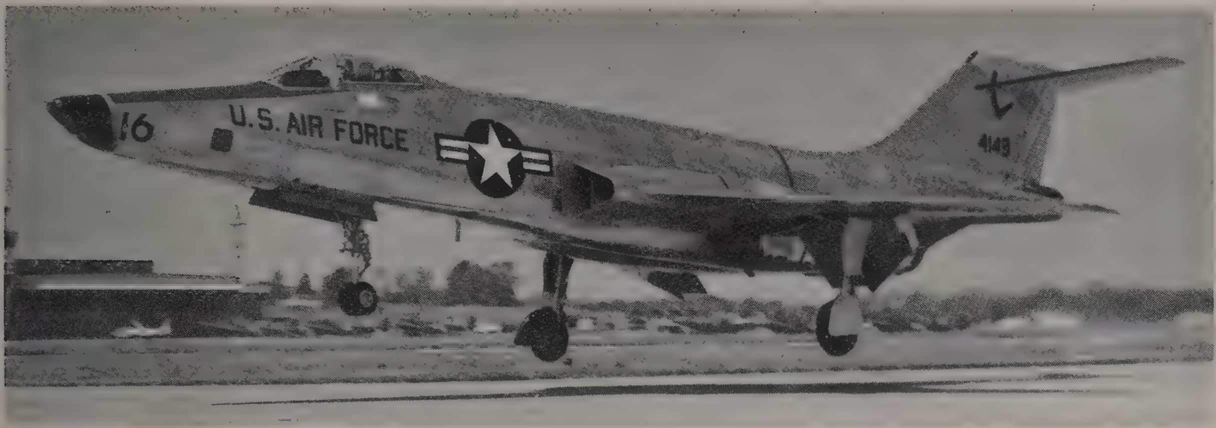
Dimensions.—
Span 39 ft. 8 in. (12.11 m.).
Length 67 ft. 5 in. (20.55 m.).
Height 18 ft. (5.49 m.).

THE McDONNELL DEMON.

U.S. Navy designation: F3H.

The Demon is a single-seat single-jet swept-wing carried-based all-weather fighter which is in production for the U.S. Navy as a successor to the F2H Banshee. The prototype XF3H-1 made its maiden flight on August 7, 1951, and the first production Demon, an F3H-1N, was

The prototype McDonnell YF-101A Voodoo Tactical Fighter (two Pratt & Whitney J57 turbojet engines).



The McDonnell RF-101A Long-Range Photographic Reconnaissance version of the F-101A.

delivered to the U.S. Navy on January 8, 1954.

The following are the production versions of the Demon :—

F3H-1N. Westinghouse J40-WE-8 engine (7,500 lb.=3,400 kg. s.t.) with afterburner. First production batch of 60. A standard F3H-1N has climbed to 10,000 ft. (3,050 m.) in 71 seconds from a standing start.

F3H-2N. Allison J71-A-2 engine (9,200 lb.=4,180 kg. s.t.) with afterburner. Second production model. Versions include F3H-2P (photographic reconnaissance) and F3H-2M (missile launcher).

The Demon, which is of all-metal construction, has sharply sweptback thin wings and tail surfaces. The primary control system incorporates complete power actuation with separately controlled "feel" forces for the pilot. The wings have power-actuated leading-edge slats and trailing-edge slotted flaps, while speed brakes are fitted on the fuselage. The entire horizontal tailplane pivots at the fuselage to provide trim and maneouvring control throughout the entire speed range.

All combat fuel is carried in internal self-sealing tanks. Provision is also made for additional fuel in jettisonable external tanks.

The pressurised cockpit, which is situated well forward for good forward and downward visibility, is provided with an ejection seat and jettisonable canopy.

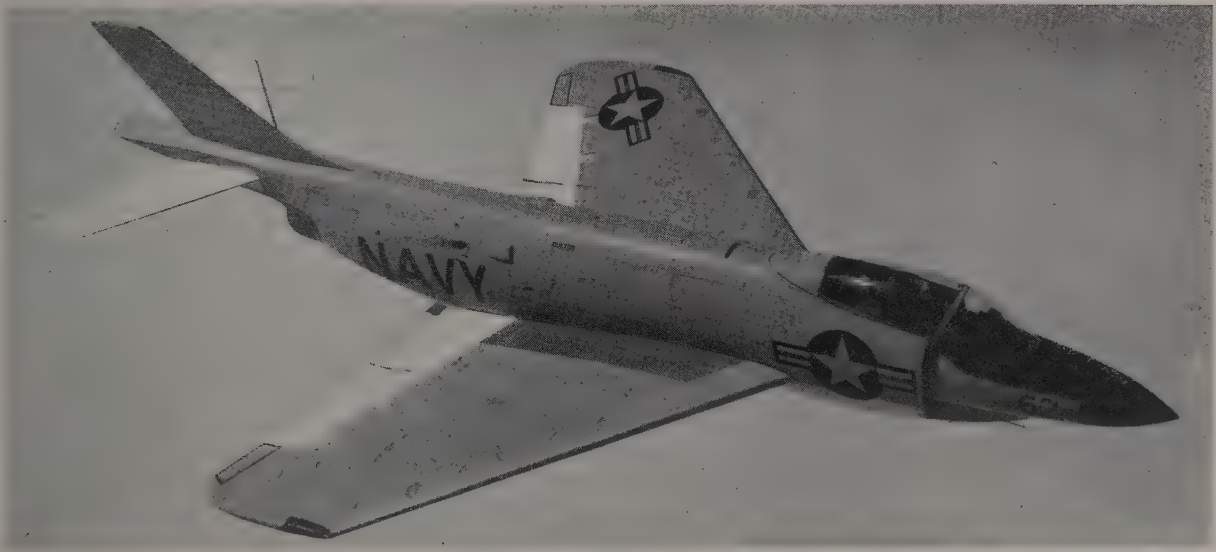
Armament consists of an unspecified number of 20 mm. cannon and various combinations of external stores, including rockets. All-weather equipment includes a new and improved type of radar and the latest developments in computing and fire-control equipment.

DIMENSIONS (Approx.).—
Span 35 ft. 4 in. (10.7 m.).
Length 59 ft. (17.9 m.).
Height 14 ft. (4.3 m.).

THE McDONNELL BANSHEE.
U.S. Navy designation: F2H.

The original contract for the design and construction of the XF2H-1 was

The McDonnell F3H-1N Demon All-weather Fighter (Westinghouse J46 turbojet engine).



The McDonnell F3H-2N All-weather Fighter (Allison J71 turbojet engine).

The McDonnell F2H-4 Banshee Naval Fighter (two Westinghouse J34 turbojet engines).

placed by the U.S. Navy in March, 1945. The first prototype flew on January 11, 1947, and the first production order for the F2H-1 was placed in May, 1947.

The Banshee finally went out of production in October, 1953, after a total of 800 of all versions had been delivered to the U.S. Navy and Marine Corps.

During 1955 the Royal Canadian Navy will be receiving sixty F2H-3 Banshee all-weather fighters, this order being fulfilled by the U.S. Navy.

F2H-1. Two Westinghouse J34-WE-22 (3,000 lb.=1,360 kg. s.t.) engines. First production model, the first example of which flew for the first time on August 10, 1949. Fifty-six built.

F2H-2. Two Westinghouse J34-WE-34 (3,150 lb.=1,430 kg. s.t.) engines. Fuselage lengthened 12 in. forward of wings to accommodate an additional 177 U.S. gallon (670 litre) internal fuel tank and two 200 U.S. gallon (756 litre) wing-tip tanks added. First of an order for 188 was flown in August, 1949. Second contract for 146 placed in September, 1949, completed in April, 1952. All F2H-2's modified for "probe-drogue" flight refuelling.

F2H-2N. Night fighter version of F2H-2. Longer nose to accommodate both armament and A.I. radar. Last of 14 delivered to U.S. Navy in June, 1951.

F2H-2P. Photographic reconnaissance version of F2H-2. New and longer heated nose can accommodate six different types of camera. Combination view-finder provides pilot with unobstructed view of terrain below and ahead. Orientation and operation of all cameras under pilot's control. Last of 58 delivered to U.S. Navy in August, 1952.

F2H-3. Long-range all-weather fighter version. Extra section inserted in mid-fuselage to accommodate two additional fuel tanks. Search radar in nose with cannon armament further aft in fuselage sides. New tailplane with slight dihedral Fitted with "probe-drogue" flight-refuelling equipment. 173 delivered to U.S. Navy.

The McDonnell F2H-3 Banshee Naval Fighter.

F2H-4. Last production model. Production completed on October 30, 1953.

DIMENSIONS.—
- Span 41 ft. 7.4 in. (12.68 m.).
- Width folded 18 ft. 5½ in. (5.60 m.).

PERFORMANCE.—
- Max. speed about 600 m.p.h. (960 km.h.).
- Speed at critical height 575 m.p.h. (920 km.h.).
- Rate of climb 9,000 ft./min. (2,745 m./min.).
- Ceiling 56,000 ft. (17,080 m.).
- Tactical radius of action 600 miles (960 km.).
- Ferry range with tip tanks 2,250 miles (3,600 km.).

THE McDONNELL MODEL 82.

U.S. Air Force designation: XV-1.

The XV-1 experimental convertiplane is a joint development of the Wright Air Development Center, U.S.A.F., the Transportation Corps of the U.S. Army and the McDonnell Aircraft Corporation. It uses a jet-driven rotor for vertical flight and wings and a normally-driven propeller for forward flight, during which the rotor autorotates at its lowest drag configuration.

The McDonnell XV-1 Experimental Convertiplane (550 h.p. Continental engine).

The McDonnell XV-1 Convertiplane (550 h.p. Continental engine) in horizontal flight.

Each of the three blades of the rotor is powered by a McDonnell pressure-jet unit located at the blade tip. A 550 h.p. Continental piston engine in the rear fuselage drives a compressor to supply air to the jet units during vertical flight, and drives the propeller during forward flight. Fuel is fed to the rotor-tip jet burners through a rotary fuel governor which is driven from the rotor hub accessory drive.

The XV-1 is designed to carry three passengers, or two stretcher patients and medical attendant, in addition to the pilot. The enclosed crew compartment is separated from the engine section by a structural firewall. Pilot and co-pilot/observer sit in tandem and are provided with removable dual controls. Exit doors may be jettisoned in an emergency.

The tail assembly consists of two vertical fins and rudders attached to the extremities of twin tail-booms. A horizontal tail surface is mounted between the booms.

The landing-gear consists of two non-retracting skids. Landing shocks are absorbed by the yielding of replaceable stainless steel straps.

The XV-1 made its first translation from vertical ot horizontal flight on April 29, 1955.

Dimensions (Approx.).—
Span 26 ft. (7.93 m.).
Length 30 ft. (9.15 m.).
Height 10 ft. 8 in. (3.26 m.).

THE McDONNELL MODEL 86.
U.S. Navy designation: XHCH-1.

The XHCH-1 now being developed for the U.S. Navy is a "flying crane" or cargo transporter for short-range work, such as ship-to-shore transfer of heavy equipment, etc. It will have a power winch and retractable cargo sling to lift and carry heavy cargo and will also be able to handle cargo "pods." It is understood that the large folding three-blade rotor will be powered with McDonnell turbojets, one at each rotor-blade tip. No other details are available for publication.

McKINNIE
McKINNIE AIRCRAFT COMPANY, INC.

Head Office and Works: P.O. Box 11, Fargo, North Dakota.

President and Chief Engineer: James McKinnie.

Vice-President: William McKinnie.

Secretary: A. I. Johnson.

McKinnie Aircraft Co., Inc., now an affiliate of Transocean Air Lines, was formed in 1947 in order to develop a new and simplified method of airframe design, and construction. The building of its first all-metal aircraft, the McKinnie 165, was completed in July, 1952, and the aircraft made its first flight on August 10, 1952.

THE McKINNIE 165.

Type.—Two-seat Light monoplane.

Wings.—Low-wing cantilever monoplane. Wing section NACA 2415 (root), NACA 2412 (tip). Aspect ratio 5.3. Chord 5 ft. (1.55 m.) at root, 3 ft. 10 in. (1.16 m.) at tip. Dihedral 7°. Incidence 3° at root, 0° at tip. All-metal structure. Spars and ribs made up from .064 gauge, and skin from .051 gauge 24ST Alclad sheet. Trailing-edge flaps and plain ailerons fabricated from .032 gauge sheet. Total flap area 13.2 sq. ft. (1.22 m.²). Total aileron area 7.5 sq. ft. (0.69 m.²). Gross wing area 106 sq. ft. (9.85 m.²).

Fuselage.—All-metal structure. Forward section a semi-monocoque, the rear section a full monocoque. Bulkheads of .064 gauge and skin of .051 gauge Alclad sheet.

Tail Unit.—Cantilever monoplane type. All surfaces fabricated from .040 gauge Alclad sheet. Areas: fin 7.5 sq. ft. (0.69 m.²), rudder 4.5 sq. ft. (0.42 m.²), tailplane 11.6 sq. ft. (1.07 m.²), elevators (total) 10.0 sq. ft. (0.93 m.²). Tailplane span 9 ft. 10 in. (2.9 m.).

Landing Gear.—Retractable tail-wheel type. Electrical retraction. Firestone rubber/sprung knee-action shock-absorber legs. Firestone cast magnesium wheels with 6.00 × 6 tyres and Firestone hydraulic single-disc brakes. Wheel track 10 ft. 3 in. (3.13 m.).

Power Plant.—One 165 h.p. Franklin 6A4-165-B3 six-cylinder horizontally-opposed air-cooled engine. Sensenich "Skyblade" two-blade selective-pitch airscrew 6 ft. 4 in. (1.93 m.) diameter. Four Goodyear Pliocel nylon fuel cells, two in each wing. Total fuel capacity 40 U.S. gallons (150 litres).

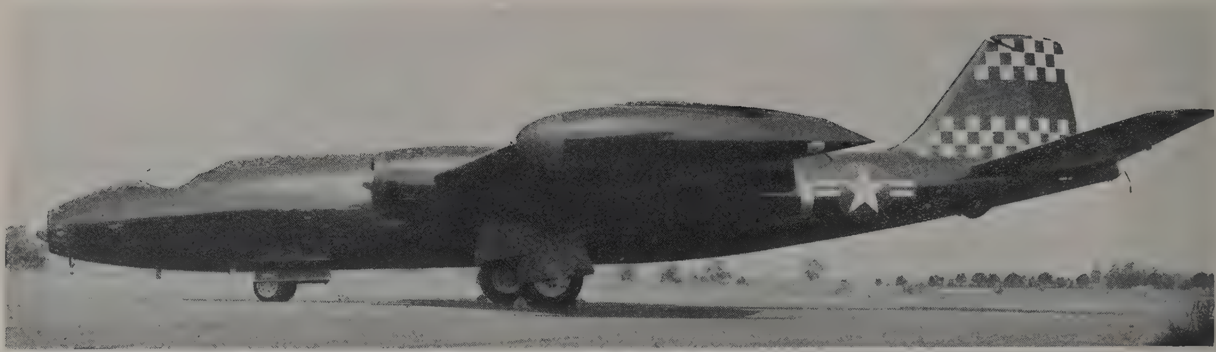
Accommodation.—Cabin seats two side-by-side with dual controls. Single-piece Lucite windshield. Entrance to cabin from either side through upward-hinging framed Lucite panels. Cabin interior 44 in. (112 cm.) wide. Baggage capacity 20 cub. ft. (0.56 m.³).

Dimensions.—
Span 23 ft. 6 in. (7.16 m.).
Length 18 ft. 3 in. (5.56 m.).
Height 7 ft. 0 in. (2.13 m.).

Weights and Loadings.—
Weight empty 1,200 lb. (545 kg.).
Crew (2) 340 lb. (154 kg.).
Fuel 240 lb. (119 kg.).
Baggage 60 lb. (27 kg.).
Weight loaded 1,840 lb. (835 kg.).
Wing loading 17.4 lb./sq. ft. (84.91 kg./m.²).
Power loading 11.1 lb./h.p. (5.04 kg./h.p.).

Performance.—
Max. speed at S/L. 175 m.p.h. (280 km.h.).
Cruising speed at S/L. 160 m.p.h. (256 km.h.).
Cruising speed at 8,000 ft. (2,440 m.) 170 m.p.h. (272 km.h.).
Stalling speed (clean) 46 m.p.h. (73.6 km.h.).
Stalling speed (flaps down) 40 m.p.h. (64 km.h.).
Initial rate of climb 1,550 ft./min. (475 m./min.).
Service ceiling 18,000 ft. (5,490 m.).
Cruising range at 8,000 ft. (2,440 m.) 720 miles (1,150 km.).
Take-off run (no wind) 400 ft. (122 m.).
Take-off to clear 50 ft. (15.25 m.) (no wind) 650 ft. (198 m.).

The McKinnie 165 Light Monoplane (165 h.p. Franklin engine).



The Martin RB-57A Reconnaissance Bomber (two Wright J65 turbojet engines). (*Gordon Williams*).

THE GLENN L. MARTIN COMPANY.

Head Office and Works: Middle River, Baltimore 3, Maryland.

Established: 1909.

Chairman of the Board and President: George M. Bunker.

Vice-President, Operations: W. B. Bergen.

Vice-President, Procurement: G. B. Shaw.

Vice-President, Industrial Relations: D. W. Siemon.

Vice-President, Sales: Jess W. Sweetser.

Vice-President—Advanced Design: G. S. Trimble, Jr.

Vice-President, Engineering: E. G. Uhl.

Vice-President, Finance: J. B. Wharton, Jr.

Vice-President, Manufacturing: G. T. Willey.

Secretary and Treasurer: W. L. Lucas.

Controller: E. R. Uhlig.

Martin activities during 1954 included the completion of the prototype XP6M-1 Sea Master, a four-jet minelaying flying-boat capable of speeds over 600 m.p.h. (960 km.h.); and continued production of P5M-2 Marlin anti-submarine warfare flying-boats for the U.S. Navy; production of B-57 twin-jet high-performance bombers and TM-61 Matador guided missiles for the U.S. Air Force; and continued development and manufacture of Viking high-altitude research rockets for the U.S. Naval Research Laboratory.

On November 22, 1954, Martin announced the receipt of a U.S.A.F. contract calling for construction of a fourth version of the basic B-57—a twin-jet dual-control conversion trainer designated B-57C.

In conjunction with the U.S.A.F. Air Research and Development Command, the Company developed the zero-length launching technique for piloted jet fighters, using the same basic principle and equipment employed in launching the TM-61 Matador missile. Piloted F-84G Thunderjet fighters were successfully launched at the Edwards AFB, California, in 1954.

The U.S. Navy's Viking rocket project, the purpose of which is to explore altitudes previously closed to research in cosmic rays, atmospheric composition, radio propagation, photography and spectroscopy, began in August, 1946.

The first Viking high-altitude research rocket was fired in May, 1949, at White Sands Proving Ground, New Mexico. It reached an altitude of 51.5 miles (82.4 km.). The most recent firing, that of the eleventh Viking was on May 24, 1954, at White Sands. This Viking set up a new record for single-stage rockets by reaching an altitude of 158 miles (252.8 km.).

Announcement also was made during 1954 of the Company's new Nuclear Division which has been established to develop nuclear reactors and related components for military, industrial and commercial use.

Martin was also engaged in the design and manufacture of electronic systems. Projects in active production during 1954 including area defense systems, guidance systems, radar and telemetering devices. A new antenna test facility and a jet engine test building were erected on Company property.

THE MARTIN MODEL 272.

U.S.A.F. designation: B-57.

The Martin company is building under licence versions of the English Electric Canberra for the U.S.A.F. The American version is powered by two Wright J65 turbojet engines.

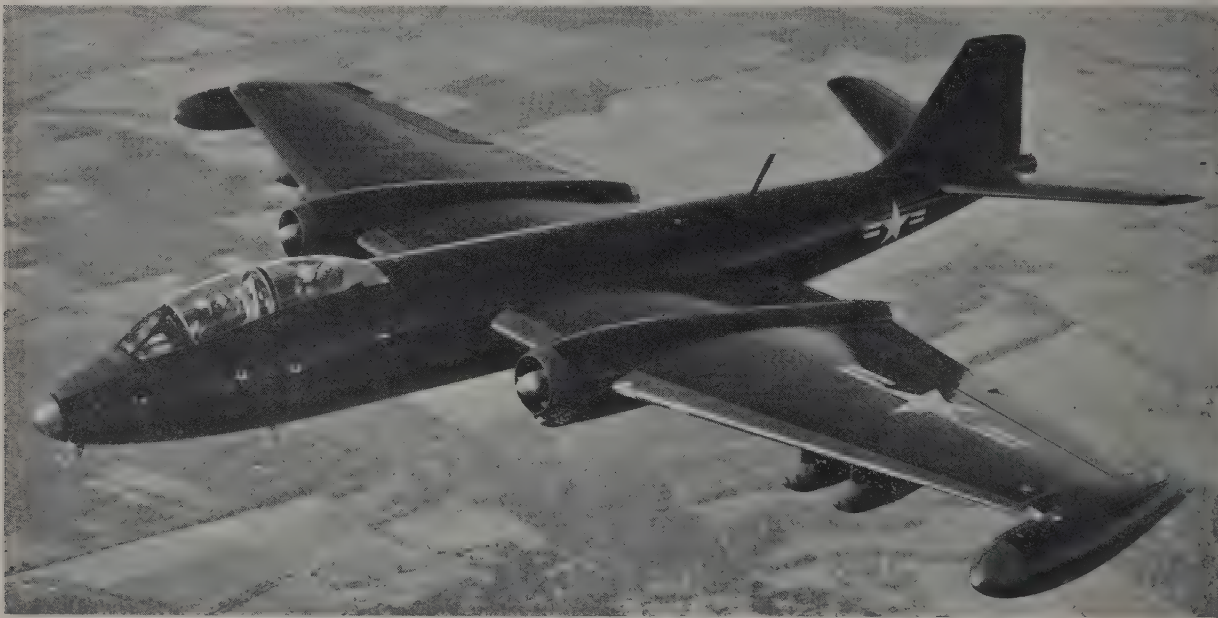
In order to convert the Canberra to fulfil its U.S.A.F. missions, as well as to adapt it to American production methods, a considerable amount of re-design was undertaken by the Martin Company.

A Martin-developed feature introduced into the B-57 is a pre-loaded revolving bomb-bay door which rotates through 180 degrees just before the bombs are released, leaving no excrescences to reduce speed on the bombing run.

In the work of conversion and adaptation Martin engineers were guided by the needs to make the B-57 an effective weapon in its new rôles; to preserve the particular characteristics of the Canberra which make it so eminently suitable for its new duties; and to engineer the design so that it can be produced as inexpensively as possible compatible with its missions.

Up to July 31, 1955, the following versions of the basic B-57 had been announced:—

B-57A. Two Wright J65-W-1 turbojet engines (7,220 lb.=3,280 kg. s.t. each). Pre-production model externally similar to the British Canberra but incorporating



The Martin B-57B Tactical Bomber (two Wright J65 turbojet engines).

many internal changes. Crew of two—pilot and navigator/radar operator/bombardier—seated side-by-side. First B-57A flew for the first time on July 20, 1953.

RB-57A. Reconnaissance version of B-57A. First RB-57A delivered to U.S.A.F. in March, 1954.

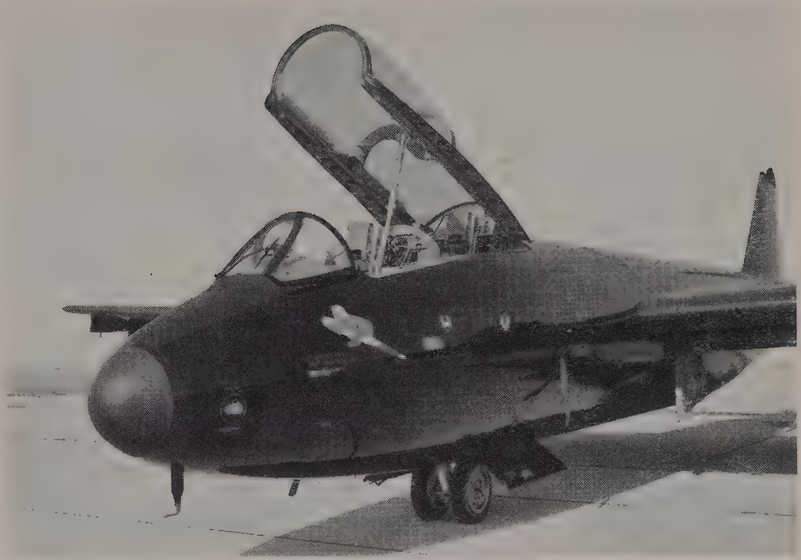
B-57B. Two Wright J65-W-5 engines (7,200 lb.=3,280 kg. s.t. each). Night intruder or tactical bomber. Crew of two, pilot and radar operator/navigator/bombardier, in tandem beneath continuous jettisonable canopy. Ejector-type seats. Improved bullet-proof windscreen with anti-icing and de-misting. Hydraulically-operated speed brakes added to rear fuselage. These move in co-ordination with "finger" type brakes on each wing. Armament consists of eight wing-mounted 50-cal. machine-guns. Four Napalm tanks in addition to eight 5-inch HVAR rockets may be carried on pylons under wings. Other stores may be carried on revolving bomb-bay door. Gross weight about 50,000 lb. (22,700 kg.). Maximum speed over 600 m.p.h. (960 km.h.), ceiling over 45,000 ft. (13,725 m.), and range more than 2,000 miles (3,200 km.). First B-57B flew for the first time on June 28, 1954.

RB-57B. Reconnaissance version of B-57B. Carries camera equipment instead of bombs.

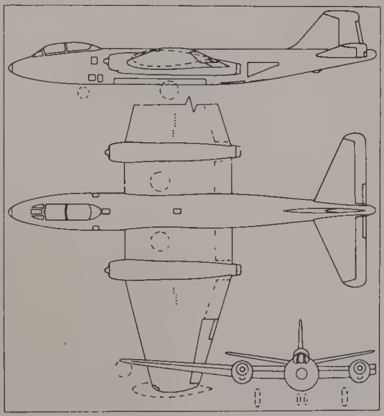
B-57C. Dual-control conversion trainer. For instrument training, for giving piston-engine pilots experience in jet operation or for giving single-engine fighter pilots multi-jet experience. Similar in appearance and performance to B-57B. The first B-57C flew on December 30, 1954.

B-57E. Modified version for use as a target-tug.

DIMENSIONS.—
Span 64 ft. (19.5 m.).
Length 65 ft. 6 in. (19.9 m.).
Height 15 ft. 7 in. (4.75 m.).



The tandem cockpit arrangement of the Martin B-57B. (*Levy-Shipp*).



The Martin B-57B.

THE MARTIN MODEL 275 SEAMASTER.

U.S. Navy designation: XP6M-1.

The XP6M-1 is a four-jet swept-wing high-performance flying-boat of advanced design. Its two primary functions will be mine-laying and photographic reconnaissance but it will also be able to undertake other combat tasks, and remain in operation—in the air or afloat—for long periods of time. Beaching-gear and other facilities permitting automatic pick-up of moorings can be carried, while air-transportable dry dock and servicing dock facilities are being built by Martin under a separate Navy contract.

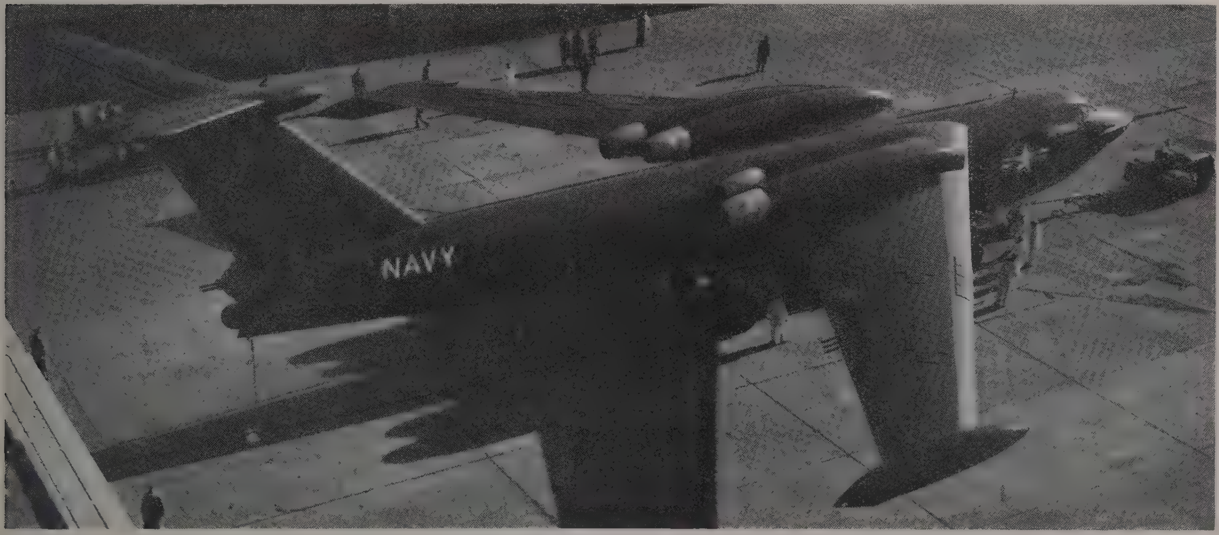
The power-plant of the XP6M-1 consists of four Allison J71 turbojet engines with afterburners. The engines are mounted in pairs in nacelles on the upper wing surfaces. The upper portions of the nacelles have hinged panels extending the full length and width of the engines to permit engine changes to be made while the aircraft is afloat.

The XP6M-1 carries a crew of five—pilot, co-pilot, navigator/minelayer, radio operator and armament operator.

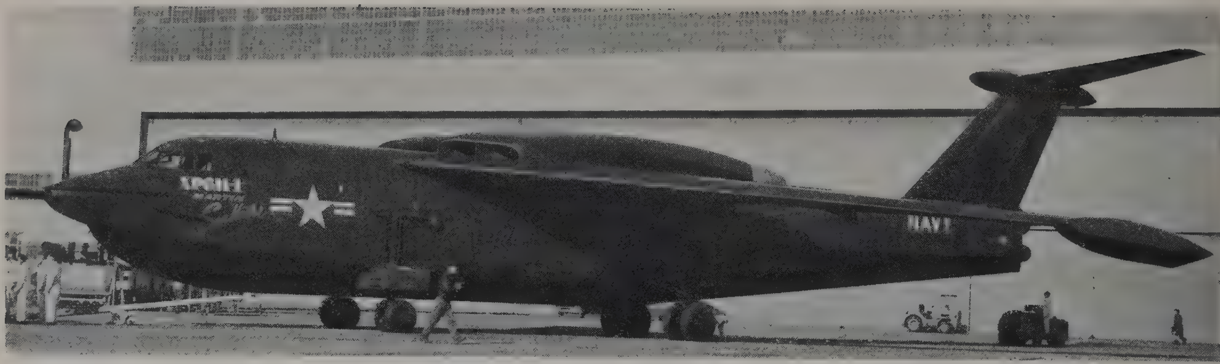
The interior arrangement of the hull includes, from nose to tail, a bow radome enclosing a radar scanner; main deck with pilot compartment; entrance compartment (with entrance door on the port side) which also serves for stowage for anchor and mooring gear; flight deck compartment for crew members; and a pressure lock for in-flight access to unpressurised areas. Beneath the flight deck is the electrical and electronics compartment. To the rear of the pressurised area is the mine-bay compartment, which includes a portion of the main wing in the upper section, fuel tanks, air conditioning and anti-icing equipment and tracks with a small trolley on which crew members pull themselves forward or aft above the store of mines or other equipment below.

Aft of the mine-bay is the mine-loading compartment which extends the full height of the hull. Mines and other stores are loaded into this compartment through a large hatch in the top of the hull. Rear compartments house electronic equipment for the tail turret and the auxiliary power-plant.

The flight deck can be pressurised to maintain a cabin altitude of 21,000 ft. (6,400 m.) against a true altitude of 50,000 ft. (15,250 m.). Provisions for emergency escape include an ejection seat for the pilot and an escape chute for other crew members extending from the flight deck down through the bottom of the hull.



The Martin XP6M-I Seamaster Flying-boat (four Allison J7I turbojet engines).



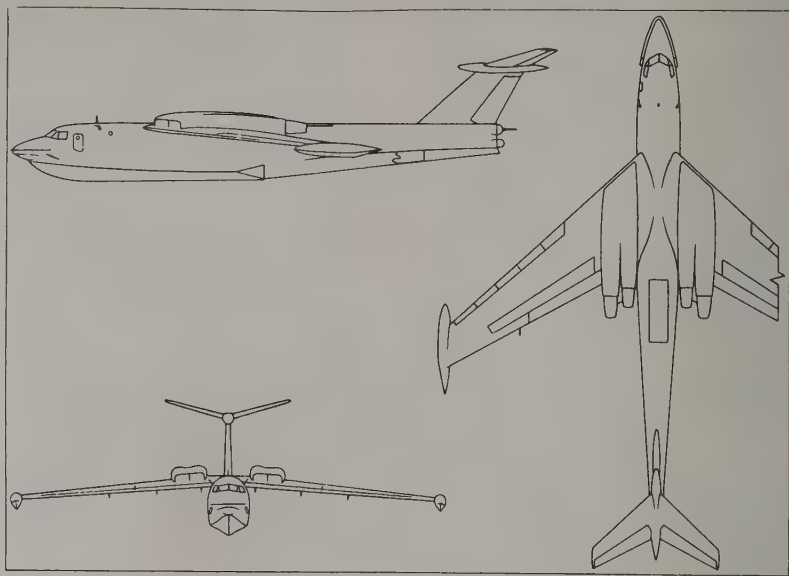
The Martin XP6M-I Seamaster Flying-boat (four Allison J71 turbojet engines).

The mine-bay is fitted with a watertight rotary mine door on which mine stores or a camera pod can be installed while the aircraft is afloat or on its beaching-gear. Watertightness is assured by a self-sealing rubber pneumatic tube system. This mine door is a development of the rotary bomb door first introduced on the Martin XB-51 and now in use on the B-57.

Other features of the XP6M-1 include fixed plastic wing-tip floats, hydroflaps on both sides of the hull afterbody, T-type tail, etc. The general arrangement of the aircraft can be gathered from the accompanying illustrations and 3-view drawing.

The XP6M-1 will have an estimated maximum speed of over 600 m.p.h. (960 km.h.) and a normal cruising altitude of 40,000 ft. (12,200 m.). No other details are available.

The XP6M-1 made its first flight on July 14, 1955.



The Martin XP6M-I Seamaster.

THE MARTIN MODEL 237 MARLIN.

U.S. Navy designation: P5M.

The P5M is the first twin-engined flying-boat to be developed for the U.S. Navy since the war.

The most characteristic feature of the P5M is the new hull design, which results from a long series of tests made, in co-operation with the Navy and the National Advisory Committee for Aeronautics, with models in the towing tank of the Stevens Institute of Technology.

From the shallow Vee step aft the hull is characterised by its depth and length. This long afterbody is designed to permit safer alightings on rough water without excessive pitching and bouncing, and to reduce normal take-off time and distance.

Hydroflaps are located near the hull

The Martin P5M-I Marlin Flying-boat (two 3,250 h.p. Wright R-3350 Turbo Compound engines).

stern post underwater. Operated hydraulically these flaps may be opened out, either independently or together, to a maximum angle of 65 degrees from the hull sides. In addition to reducing the turning radius, the hydro flaps may be used as water brakes for quicker stops in restricted areas.

The first experimental prototype to test the new hull design, later to become the XP5M-1, was a hybrid, the experimental hull being fitted with a set of PBM Mariner wings off the production line. A single fin and rudder replaced the twin tail of the Mariner and Wright R-3350 engines were installed. Control power boost was added. The prototype XP5M-1 flew for the first time on May 4, 1948, and was tested by the U.S. Navy in 1949-50.

In the meantime proposals for a PBM Mariner replacement based on experience and test results obtained with the hybrid boat were submitted to and accepted by the U.S. Navy, but during the initial design stages the mission was changed from that of patrol to high-priority anti-submarine warfare.

Engineering for the production version was therefore directed towards producing the most potent ASW weapon. Fitted with the most powerful tactical radar in any U.S. aircraft, the P5M Marlin, which carries a crew of seven, is equipped with the latest types of magnetic detection equipment, sonobuoys, searchlight, cameras for reconnaissance and damage-assessment, etc.

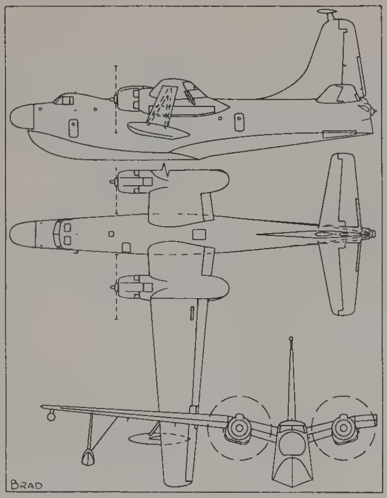
The gull wings and stabilising floats are similar to those of the PBM Mariner but the P5M has a new single vertical tail surface. The power plant consists of two Wright R-3350 Turbo Compound engines mounted in nacelles which, as with those of the PBM, have a bay beneath the wings for the stowage of bombs, mines, depth-charges, etc.

Substantial orders for the P5M have been received by the Martin company and production was started in January, 1951.

Two versions of the Marlin exist. These are identified as follows :—

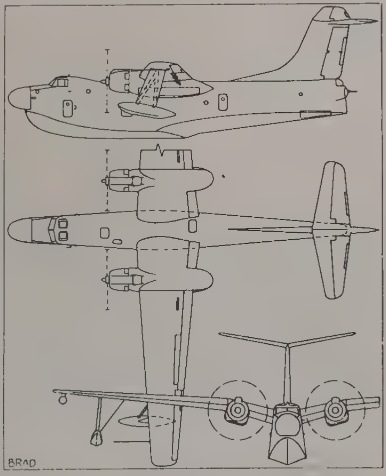
P5M-1. Two 3,250 h.p. Wright R-3350-30W Turbo Compound engines. First production version. Low tailplane. First production Marlin flew for the first time on June 22, 1951, and the first P5M-1 was delivered to the U.S. Navy in December, 1951. Deliveries continued throughout 1953 and into 1954. A number of ASR versions of the P5M-1 were delivered to the U.S. Coast Guard in the Autumn of 1953.

P5M-2. Two 3,450 h.p. Wright R-3350-32W Turbo Compound engines. Development of P5M-1. Chief external difference is the new "T" tail with the horizontal surfaces on top of the fin. Also has a lower bow chine line to reduce spray damage to the airscrews, increased fuel capacity, the latest ASW electronic equipment, and a rearrangement of much of the interior equipment for greater operational comfort and convenience. In production. The first P5M-2 first flew in August, 1953. First P5M-2 delivered to U.S. Navy on June 23, 1954.



The Martin P5M-I Marlin.

The general structure of the P5M-1 and P5M-2 is similar. The description below applies primarily to the P5M-2 except where indicated.



The Martin P5M-2 Marlin.

TYPE.—Twin-engined Anti-Submarine Warfare flying-boat.

WINGS.—Gull-wing cantilever monoplane. Wing section NACA 23020 at root, NACA 4412 at tip. Dihedral 16° inner gull section, 3° outboard of nacelles. Gull-wing centre-section integral with hull, outer panels and tips removable. Goodrich de-icing boots on leading-edges. All-metal three-spar box structure. Conventional trailing-edge ailerons have metal D-spar leading-edges, metal ribs and fabric covering. All-metal spoiler ailerons operating in conjunction with the conventional ailerons to counteract any rolling tendencies that might develop at take-off or alighting in rough water, are located inboard of main ailerons in line of rear spar. All-metal trailing-edge flaps between ailerons and nacelles and nacelles and hull. Total conventional aileron area (including tabs) aft of hinge line 65.93 sq. ft. (6.13 m.^{2}). Total spoiler aileron area 46.49 sq. ft. (4.32 m.^{2}). Total flap area 204.3 sq. ft. (18.97 m.^{2}). Gross wing area (including 103.32 sq. ft. = 9.59 m.^{2} of hull) 1,406.33 sq. ft. (130.65 m.^{2}).

HULL.—All-metal semi-monocoque structure. Single faired V-type step and long planing afterbody. New lower bow chine line, as compared with P5M-1, results in reduction of spray height and permits take-off in heavier seas at greater A.U.W. Martin-developed hydraulically-operated hydro-flaps one on each side of after hull bottom serve as water rudders when operated individually or as water brake or sea anchor when both extended together. All-metal wing-tip stabilising floats.

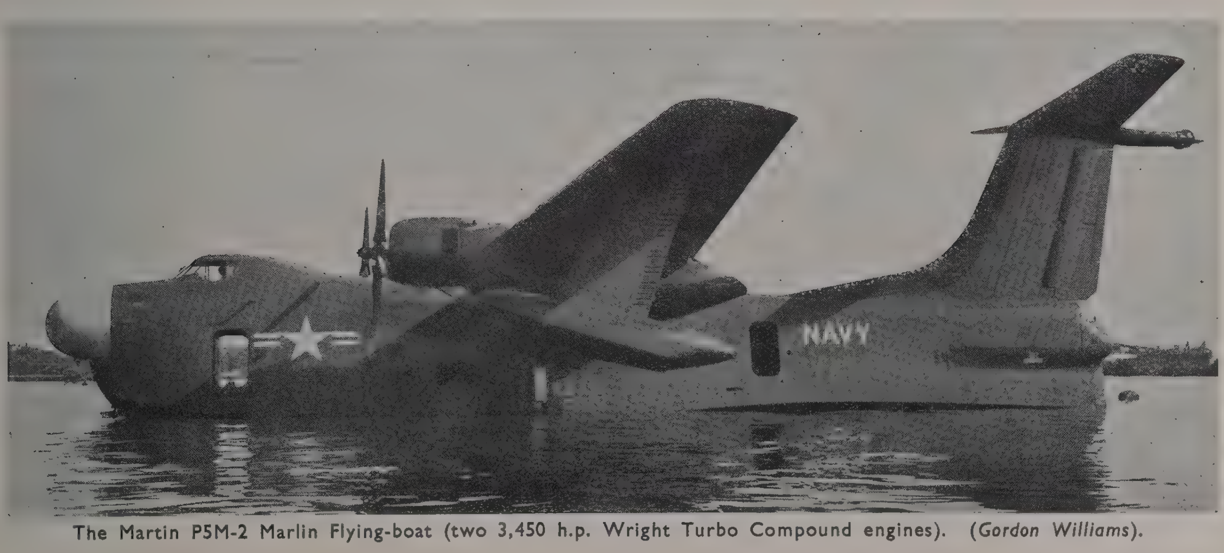
TAIL UNIT (P5M-2).—Cantilever all-metal T-type structure. Areas: fin, including 26 sq. ft. = 2.41 m.^{2} of dorsal fin and 17.7 sq. ft. = 1.64 m.^{2} of contained rudder balance 177 sq. ft. (16.44 m.^{2}), rudder, aft of hinge line, 49 sq. ft. (4.55 m.^{2}), tailplane including 32.4 sq. ft. = 3.0 m.^{2} of contained elevator balance 173 sq. ft. (1.60 m.^{2}), elevators, aft of hinge line 89 sq. ft. (8.26 m.^{2}).

POWER PLANT.—Two 3,250 h.p. Wright R-3350-30W (P5M-1) or 3,450 h.p. R-3350-32W (P5M-2) Turbo Compound engines. Hamilton Standard airscrews. Fuel tanks in hull and centre wing section are of self-sealing Mareng type. Two non-self-sealing auxiliary tanks outboard of service tanks, one in each wing panel. Provision for jettisoning fuel and for purging interior of auxiliary tanks and spaces surrounding hull tanks with carbon-dioxide for combat protection. In P5M-1 two droppable tanks can be installed, one in each nacelle bomb-bay. Total fuel capacities 2,815 U.S. gallons (10,640 litres) in P5M-1, 3,635 U.S. gallons (13,740 litres) in P5M-2.

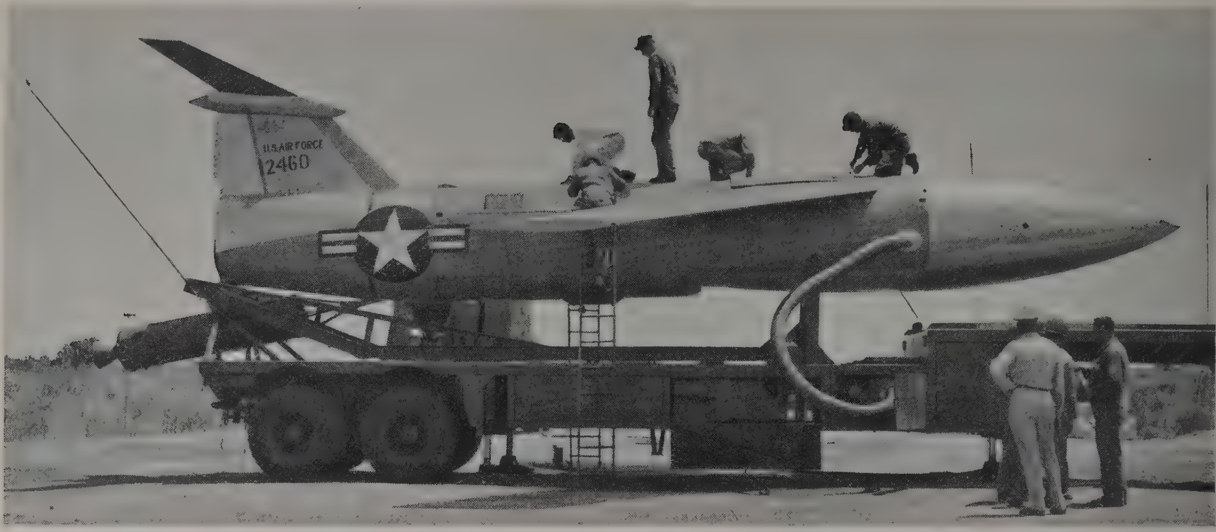
ACCOMMODATION.—Crew of seven. Details of interior accommodation not available.

ARMAMENT.—Defensive armament in remote controlled tail-turret. Bomb-bays in engine nacelles for various types of offensive stores.

EQUIPMENT.—Magnetic airborne detector (AN/ASQ-8 MAD) unit in tubular plastic fairing extending aft from horizontal-vertical tail juncture AN/APS-44A radar scanner in nose radome. Camera installation for damage estimation by day or by night in streamline pod which can be attached to outside of hull. Hoisting



The Martin P5M-2 Marlin Flying-boat (two 3,450 h.p. Wright Turbo Compound engines). (*Gordon Williams*).



The Martin TM-61 Matador Tactical Missile being fueled on its mobile launcher. (*Gordon Williams*).

points on centre-line of hull at wings for hoisting craft aboard seaplane tender at 60,000 lb. (27,240 kg.) gross weight. Beaching-gear to support gross weight of 78,500 lb. (35,640 kg.) can be stowed aboard partially dis-assembled.

DIMENSIONS (P5M-1).—
Span 118 ft. 2¼ in. (36.0 m.).
Length 94 ft. 6 in. (28.82 m.).
Height 38 ft. 5 in. (11.71 m.).

DIMENSIONS (P5M-2).—
Span 118 ft. 2¼ in. (36.0 m.).
Length 98 ft. 11 in. (30.18 m.).
Height 33 ft. (10.06 m.).

WEIGHTS (P5M-1).—
Weight empty 46,642 lb. (21,175 kg.).
Weight loaded 72,837 lb. (33,070 kg.).

WEIGHTS (P5M-2).—
Weight empty 46,933 lb. (21,310 kg.).
Weight loaded 73,055 lb. (33,166 kg.).

PERFORMANCE (P5M-1 and P5M-2).—
Max. speed 250 m.p.h. (400 km.h.).
Max. diving speed 302 m.p.h. (483 km.h.).
Alighting speed 97 m.p.h. (155 km.h.).
Most efficient search altitude 1,500 ft. (460 m.).

THE MARTIN MATADOR.

U.S.A.F. designation: TM-61.

The TM-61 Matador ground-launched medium-range tactical guided missile, which was developed and built for the U.S.A.F. Research and Development Command, began its tactical tests at the U.S.A.F. Missile Test Center at Cocoa Florida, on June 21, 1951, the initial launch using for the first time the "down-range" facilities in the Bahama Islands. Previous flight control tests were made at the Holloman Air Force Base, New Mexico.

Assigned to the Tactical Air Command, the TM-61 is now being used to train personnel in the operation of this new type of weapon at the Patrick AFB, Florida. The first Tactical Missile Squadron equipped with TM-61's was formed on October 1, 1951, and early in 1954 two squadrons were ordered to duty in Western Germany, the first overseas deployment of any remotely-controlled pilotless weapon.

The TM-61 is a swept-wing missile which takes off from a mobile launcher under rocket and jet power. When a critical speed is reached the missile's Allison J-33-A-37 "short-life" turbojet engine takes over and the rocket drops off. The missile is controlled electronically in flight.

DIMENSIONS.—
Span 28 ft. 8½ in. (8.75 m.).
Length 39 ft. 7 in. (12.0 m.).

PERFORMANCE.—
Speed over 650 m.p.h. (1,040 km.h.).
Ceiling over 35,000 ft. (10,675 m.).

MONOCOUPE

MONOCOUPE AIRCRAFT OF FLORIDA, INC.

HEAD OFFICE AND WORKS: Box "F," MELBOURNE, FLORIDA.

President: Robert G. Sessler.

Monocoupe Aircraft of Florida, Inc. is successor to the Monocoupe Airplane and Engine Corporation also of Melbourne and formerly of Orlando, Florida. The new company has developed a completely new twin-engined 4/5-seat all-metal monoplane which is described and illustrated herewith.

The Monocoupe Meteor (two 150 h.p. Lycoming O-320 engines).

THE MONOCOUPE METEOR.

TYPE.—Twin-engined Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23015 tapered to 23012. Aspect ratio 7.2. Dihedral 3°. Mean chord 5 ft. (1.52 m.). All-metal stressed-skin monocoque structure. Slotted flaps. Composite Frise and plain type ailerons. Gross wing area 180.1 sq. ft. (16.73 m.²).

FUSELAGE.—All-metal stressed-skin structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Areas: fin 6.5 sq. ft. (0.60 m.²), rudder 7.9 sq. ft. (0.73 m.²), tailplane 16.1 sq. ft. (1.49 m.²), elevators 13.2 sq. ft. (1.23 m.²). Span of tail 10 ft. (3.05 m.).

LANDING GEAR.—Retractable nose-wheel type. Electrol air/oil shock-absorbers. Hydraulic retraction. Goodrich wheels and brakes. Track 11 ft. (3.35 m.). Wheelbase 8 ft. 2 in. (2.49 m.).

POWER PLANT.—Two 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engines. Hartzell two-blade constant-speed feathering airscrews. All fuel in two wing-tip tanks. Total fuel capacity 90 U.S. gallons (340 litres). Oil capacity 10 U.S. gallons (38 litres).

ACCOMMODATION.—Enclosed cabin seats four/five.

DIMENSIONS.—
Span 36 ft. (10.98 m.).
Length 27 ft. 2 in. (8.28 m.).
Height 9 ft. 6 in. (2.89 m.).

WEIGHTS.—
Weight empty 1,850 lb. (840 kg.).
Weight loaded 3,100 lb. (1,407 kg.).

PERFORMANCE.—
Max. speed 192 m.p.h. (307 km.h.).
Cruising speed (70% power) at 6,000 ft. (1,830 m.) 175 m.p.h. (280 km.h.).

MOONEY

MOONEY AIRCRAFT, INC.

HEAD OFFICE AND WORKS: LOUIS SCHREINER FIELD, KERRVILLE, TEXAS.

President and Chairman of the Board: Hal F. Rachal.

Executive Vice-President and Sales Manager: Norman F. Hoffman.

Secretary, Treasurer and General Manager: W. W. Evans.

Chief Engineer: Albert W Mooney.

The Mooney Aircraft, Inc. was formed to build the M-18 single-seat light monoplane, which was designed for extremely economical operation.

A new product is the M-20 four-seat cabin monoplane which received its Approved Type Certificate in August, 1955.

The Mite Model M-18C55 incorporates the Mooney "Safe-Trim" trimming system which combines the trim and flap controls so as to establish automatically proper settings for take-off, climb, approach and landing The M-20 employs an adjustable tailplane with separate control for flaps.

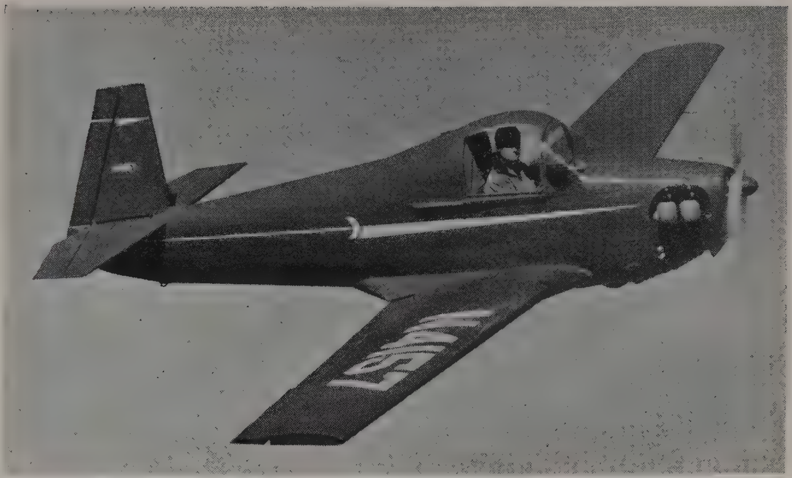
THE MOONEY MITE MODEL M-18C55.

TYPE.—Single-seat Light monoplane.

WINGS.—Low-wing cantilever monoplane. Single spruce and plywood D-spar structure with fabric covering aft of spar. Ailerons and flaps have welded steel-tube frames and fabric covering. Gross wing area 95 sq. ft. (8.82 m.²).

FUSELAGE.—Mixed structure. Front section to back of pilot's cockpit of welded steel-tube with sheet aluminium-alloy covering, rear section a wood monocoque.

TAIL UNIT.—Cantilever monoplane. End of fuselage hinged beneath leading-edge of tailplane for trim. All surfaces of welded steel-tube with fabric covering.



The Mooney Mite M-18C55 (65 h.p. Continental A65 engine).

Landing Gear.—Retractable tricycle with steerable nose wheel. Rubber shock-absorbers. Hand retraction by lever in cockpit. Warning horn provided. Wheel brakes.

Power Plant.—One 65 h.p. Continental A65-8 four-cylinder horizontally-opposed air-cooled engine driving a two-blade fixed-pitch Flottorp airscrew. Fuel tank (14 U.S. gallons = 53 litres) in fuselage.

Accommodation.—Single-seat cockpit with sliding canopy. Standard three-control system with stick and rudder pedals. Interconnected flaps and tail trim.

Dimensions.—
- Span 26 ft. 10½ in. (8.2 m.).
- Length 17 ft. 7¼ in. (5.45 m.).
- Height 6 ft. 2½ in. (1.9 m.).

Weights and Loadings.—
- Weight empty 500 lb. (227 kg.).
- Disposable load 350 lb. (159 kg.).
- Weight loaded 850 lb. (386 kg.).
- Wing loading 8.94 lb./sq. ft. (43.62 kg./m.^{2}).
- Power loading 13 lb./h.p. (5.9 kg./h.p.).

Performance.—
- Max. speed at S/L. 142 m.p.h. (227 km.h.).
- Optimum cruising speed at 10,000 ft. (3,050 m.) 130 m.p.h. (208 km.h.).
- Economic cruising speed at S/L. 115 m.p.h. (184 km.h.).
- Stalling speed (power off) 43 m.p.h. (69 km.h.).
- Rate of climb at S/L. 1,090 ft./min. (332 m./min.).
- Service ceiling 19,400 ft. (5,920 m.).
- Take-off distance to clear 50 ft. (15.25 m.) 525 ft. (160 m.).
- Landing distance from 50 ft. (15.25 m.) 860 ft. (260 m.).
- Range 500 miles (800 km.).

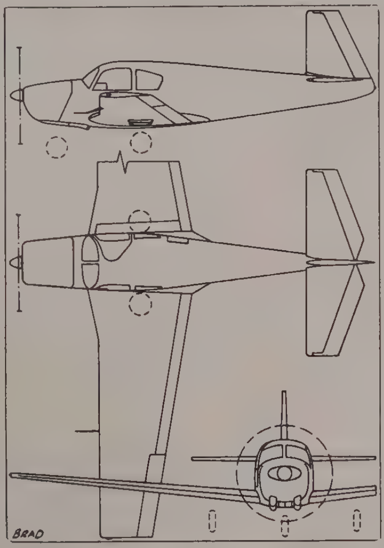
THE MOONEY M-20 MARK 20.

Type.—Four-seat cabin monoplane.

Wings.—Low-wing cantilever monoplane. NACA laminar-flow wing section. Single-piece single-spar structure with plywood torsion-box leading-edge and fabric covering aft. Narrow-chord slotted flaps over 70 per cent. of trailing-edge. Sealed gap differentially-operated ailerons. Gross wing area 166.9 sq. ft. (15.50 m.^{2}).

Fuselage.—Composite all-metal structure. Cabin section is of welded steel-tube with sheet aluminium-alloy covering. Rear section is of aluminium-alloy with internal formers and stringers.

Tail Unit.—Cantilever monoplane type. Tailplane and fin are single spar structures with plywood torsion-box leading-edge and plywood covering aft. All control surfaces have welded steel-tube frames with fabric covering. Tailplane span 11 ft. 8 in. (3.55 m.).



The Mooney M-20 Mk. 20.

Landing Gear.—Retractable nose-wheel type. Rubber-in-compression with rebound control shock-absorbers. Steerable nose-wheel. Hand retraction by lever in cockpit between front seats. Hydraulic brakes on main wheels. Track: 9 ft. 2 in. (2.79 m.). Wheelbase: 5 ft. 6$\frac{9}{16}$ in. (1.68 m.).

Power Plant.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine. Hartzell two-blade all-metal constant-speed airscrew with Hamilton Standard governor. Diameter of airscrew 6 ft. 2 in. (1.88 m.). Fuel capacity 50 U.S. gallons (190 litres).

Accommodation.—Cabin seats four in two pairs, front pair with dual controls. Starboard front and rear seats removable for freight stowage. Single door on each side giving access to all seats. Baggage compartment behind cabin with access from cabin or through outside door.

Dimensions.—
- Span 35 ft. (10.67 m.).
- Length 23 ft. 2⅜ in. (7.07 m.).
- Height 8 ft. 3½ in. (2.52 m.).

Weights and Loadings.—
- Weight empty equipped 1,335 lb. (606 kg.).
- Pilot and 3 passengers 680 lb. (310 kg.).
- Fuel and oil 315 lb. (143 kg.).
- Baggage 120 lb. (54 kg.).
- Weight loaded 2,450 lb. (1,112 kg.).
- Wing loading 14.67 lb./sq. ft. (70.36 kg./m.^{2}).
- Power loading 16.33 lb./h.p. (7.41 kg./h.p.).

Performance (Standard airscrew).—
- Max. speed at S/L. 175 m.p.h. (280 km.h.).
- Optimum cruise (75% power) at 7,000 ft. (2,135 m.) 170 m.p.h. (272 kmh.).
- Economic cruise (60% power) at 7,000 ft. (2,135 m.) 150 m.p.h. (240 km.h.).
- Landing speed (flaps at 50°) 50 m.p.h. (80 km.h.).
- Rate of climb at S/L. over 950 ft./min. (290 m./min.).
- Service ceiling over 18,000 ft. (5,490 m.)
- Absolute ceiling over 20,000 ft. (6,100 m.).
- Range at optimum cruise 890 miles (1,425 km.) in 5.4 hours.
- Range at economic cruise 1,000 miles (1,600 km.) in 6.7 hours.

The Mooney M-20 Mk. 20 (150 h.p. Lycoming O-320 engine).

NORTH AMERICAN

NORTH AMERICAN AVIATION, INC.

Head Office and Works: International Airport, Los Angeles 45, Cal.

Other Production Plants: Columbus, Ohio, Downey and Fresno, California.

Chairman of the Board: J. H. Kindelberger.

President: J. L. Atwood.

Vice-President in charge of Engineering: R. H. Rice.

Vice-President in charge of Manufacturing: J. S. Smithson.

Vice-President in charge of Electro-Mechanical Division, Aero-Physics and Atomic Energy Laboratories: L. L. Waite.

Vice-President and General Manager, Columbus Division: C. J. Gallant.

Vice-President: A. T. Burton.

Vice-President and Treasurer: R. A. Lambeth.

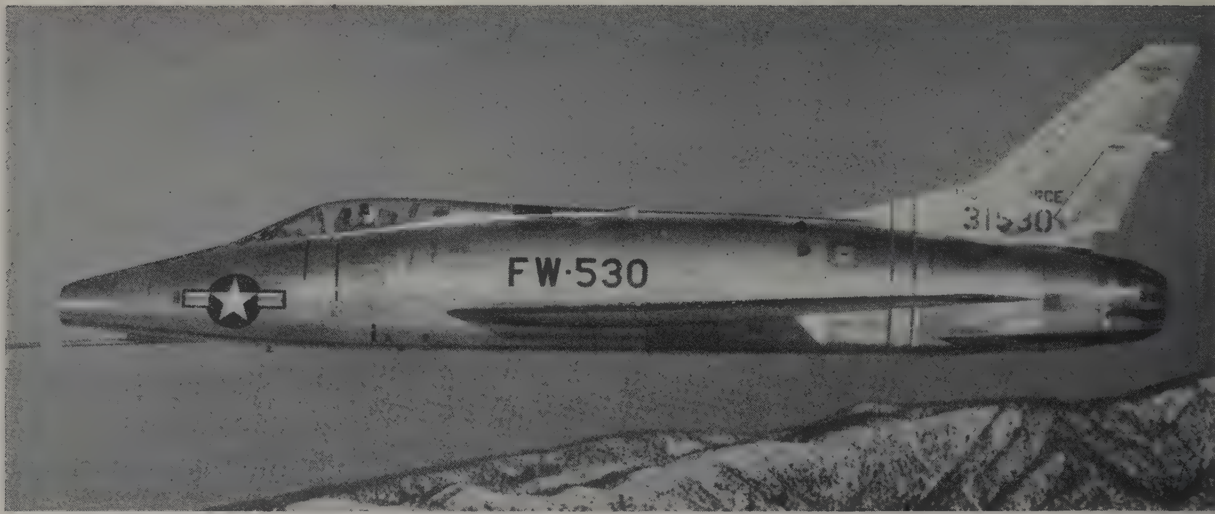
Secretary: S. G. Anspach.

North American Aviation, Inc., was incorporated in Delaware in 1928 and from 1934 until 1945 was engaged solely in the design and manufacture of military aircraft. Manufacturing facilities were established at Inglewood, California, in 1935, where a modern production plant was erected on the Los Angeles Municipal Airport. Other facilities have since been acquired in the Los Angeles area.

The company is now engaged in the development, design and manufacture of military aircraft and in research and development in electro-mechanics, aero-physics and atomic energy.

In 1954 North American delivered to the U.S. Air Force, U.S. Navy and U.S. Marine Corps substantial quantities of six different jet fighter and interceptor aircraft. The F-100 supersonic fighter, the F-86D and F-86K interceptors and the F-86H fighter-bomber are currently in production for the U.S. Air Force. Production of the FJ-2 carrier-based fighter came to an end during the year, giving place to the FJ-3 which is now being delivered to the U.S. Navy.

The AJ-2 and AJ-2P attack bomber programmes were completed, while production of the U.S. Air Force T-28A trainer gave place to the U.S. Navy T-28B trainer.



The North American F-100A Super Sabre (Pratt & Whitney J57 turbojet engine).

North American is participating in a large modernisation programme, initiated by the U.S. Air Force, to increase further the effectiveness of the F-86D interceptor.

The company's Missile and Control Equipment programme includes operations in all the major phases of missile airframe design, rocket engine propulsion, automatic guidance and control equipment. Under development is the SM-64 Navaho surface-to-surface guided missile, no details of which are available for publication.

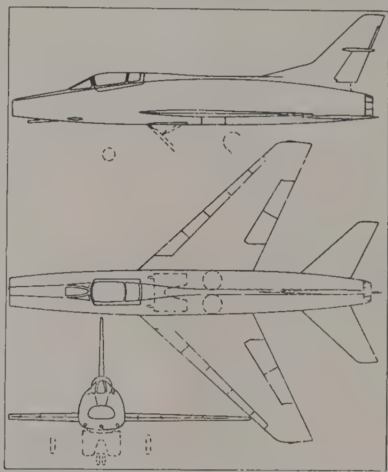
Total employment at the Los Angeles, Columbus, Downey and Fresno plants at the end of the company's 1954 fiscal year was 54,930, the highest it had been for ten years.

THE NORTH AMERICAN SUPER SABRE.

U.S. Air Force designation: F-100.

The F-100 was the first supersonic operational fighter to be developed for the U.S.A.F. The prototype YF-100A, powered by a Pratt & Whitney J57-P-7 turbojet engine fitted with an afterburner, flew for the first time on May 25, 1953. It exceeded the speed of sound in level flight on its first 35-minute flight.

On October 29, 1953, Lieut. Colonel F. K. Everest, U.S.A.F. set up a World's Speed Record over a 15-km. course in the YF-00A Super Sabre with an average speed of 755.149 m.p.h. (1,207.96 km.h.). The two runs over the Salton Sea measured course were made at 767.276 m.p.h. (1,227.64 km.h.) and 742.684 m.p.h. (1,188.39 km.h.) respectively. Both flights were made at about 100 ft. (30.5 m.) above the course, which is itself about 250 ft. (76.25 m.) below sea level. The air temperature at the time of the record flight was 87°F.



The North American F-100A Super Sabre.

On August 20, 1955, Colonel H. A. Hanes, U.S.A.F., flying an F-100C Super Sabre established a new high-altitude supersonic speed record of 822.125 m.p.h. (1,323 km.h.). This record was made at a height of about 35,000 ft. (10,670 m.) under new F.A.I. regulations.

The F-100 has been in production at North American's main plant in Los Angeles since mid-1953, and tooling for additional F-100 production was put in hand at Columbus, Ohio, in the Autumn of 1954. Deliveries to the U.S.A.F. from the Los Angeles plant began in September, 1954.

Several new development projects based on the F-100 configuration have been officially authorised. The following have been mentioned :—

F-100B. All-weather fighter. Design has been revised sufficiently to justify re-designation as F-107A.

F-100C. Fighter-bomber. Fitted with in-flight refueling system and provision for carrying extra fuel drop tanks and bombs under the wings. Improved electronic bombing equipment. Standard armament of four 20 mm. cannon. First F-100C flew on January 17, 1955.

F-100D. Fighter-bomber.

A two-seat trainer version is also being developed.

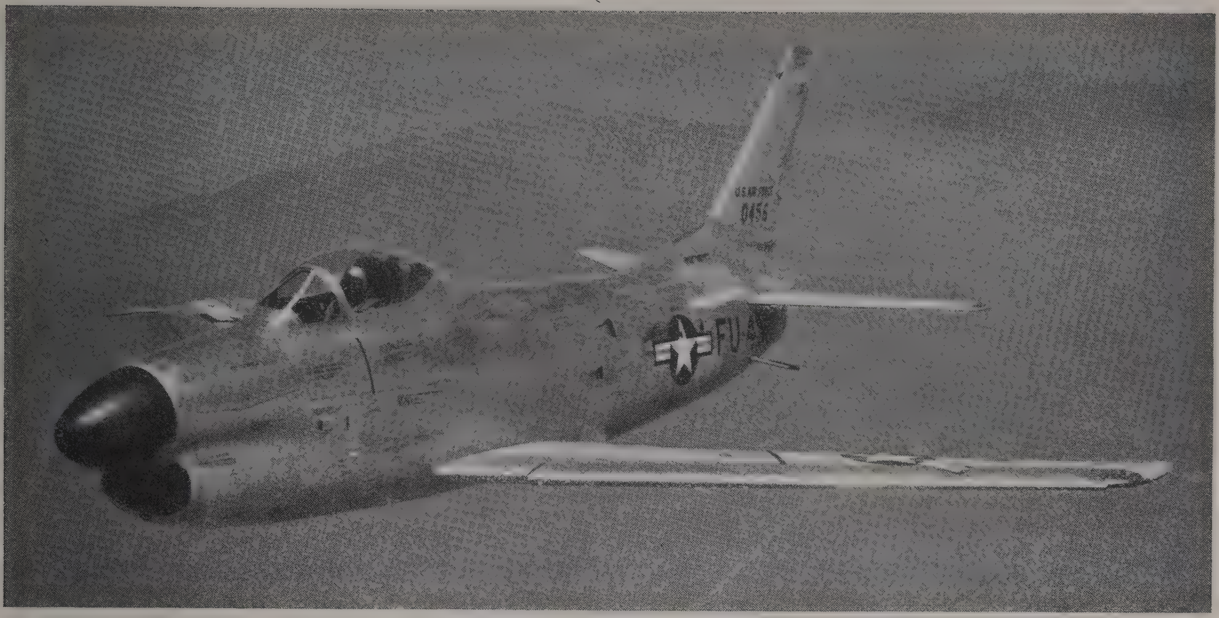
The following brief description refers specifically to the F-100A.

TYPE.—Single-seat supersonic Fighter.

WINGS.—Low-wing cantilever monoplane. 45° sweepback aluminium alloy spars, ribs and tapered skin. Automatic leading-edge slats.

FUSELAGE.—All-metal structure. Rectangular air brake hinged beneath fuselage approximately in line with front wing spar.

The North American F-100C Super Sabre Fighter Bomber taking off on its first flight.



The North American F-86D Sabre All-weather Fighter (General Electric J47 turbojet engine).

Tail Unit.—Monoplane type. All surfaces have 45° sweepback. One-piece "all-flying" horizontal stabiliser. Span of tail 18 ft. (5.5 m.).

Landing Gear.—Retractable tricycle type. Track of main wheels 12 ft. (3.6 m.).

Power Plant.—One Pratt & Whitney J57-P-7 turbojet engine with afterburner. Automatic fuel system.

Accommodation.—Pilot's cockpit forward of wings with one-piece clamshell-type jettisonable canopy. Automatically-regulated air conditioning and pressurising system. Ejection seat.

Dimensions (Approx.).—
Span 36 ft. 9½ in. (11.22 m.).
Length 46 ft. 2½ in. (14.09 m.).
Height 13 ft. 3½ in. (4.05 m.).

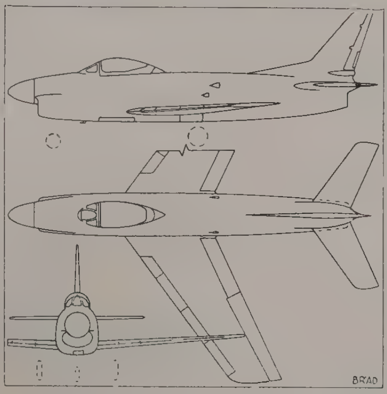
Weight.—
No data available.

Performance.—
Max. speed with afterburner 750-760 m.p.h. (1,200-1,216 km.h.) at S/L.
Service ceiling over 50,000 ft. (15,250 m.).
Combat radius 575 miles (920 km.).

THE NORTH AMERICAN SABRE.
U.S. Air Force designation: F-86.

The F-86 was the first American swept-wing fighter to go into combat. In two years of fighting in Korea the F-86 maintained its superiority over the Russian MIG-15 and set up an impressive combat record.

The Sabre is being built under licence in Canada by Canadair, Ltd. and in



The North American F-86D Sabre.

Australia by the Commonwealth Aircraft Corporation Pty. Ltd. The Canadian production Sabre has been supplied in quantity to the R.C.A.F., U.S.A.F. and R.A.F. The first series, known as the Sabre Mk. 2, was powered by the General Electric J47 engine supplied from the United States. The later Sabre Mks. 5 and 6 are fitted with the Canadian Orenda turbojet engine. The Australian-built Sabre is fitted with the Rolls-Royce Avon engine, which is also being manufactured in Australia.

The F-86K has been ordered by the U.S.A.F. under the Mutual Defense Assistance Programme for delivery to N.A.T.O. countries. Fifty will be assembled in Italy by Fiat.

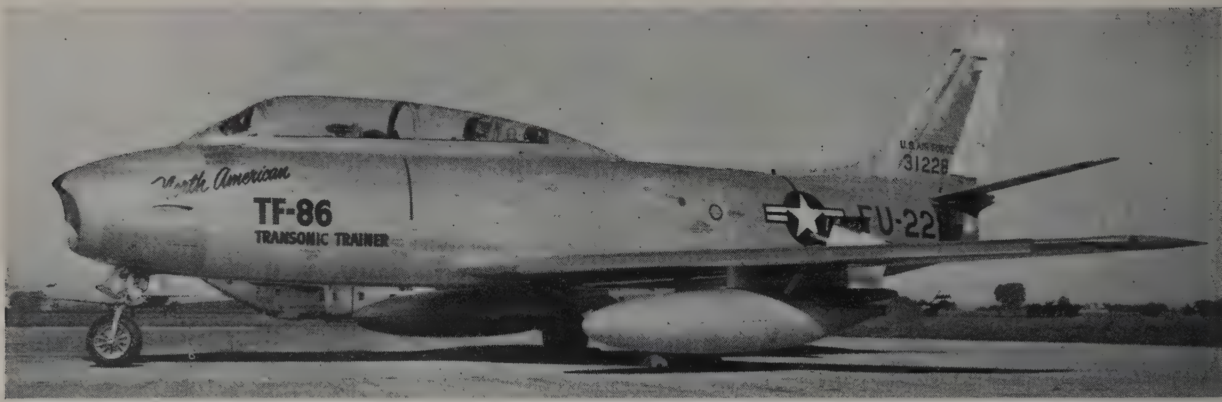
The following are the principal versions of the F-86 :—

XF-86. Two prototypes originally fitted with the Allison J35-GE-3 engine. First prototype flew on October 1, 1947. Were later re-engined with the General Electric J47. Re-engined XF-86 first exceeded Mach. 1 on April 25, 1948.

F-86A. First production model. One General Electric J47-GE-1, -3, -9 and -13 engines in successive production series. First production aircraft flew on May 20, 1948. On September 15, 1948, a standard F-86A complete with armament and normal combat equipment and flown by Major Richard L. Johnson, U.S.A.F. established a World's Speed Record of 670.981 m.p.h. (1,073.569 km.h.) over the measured course on Muroc Lake. Out of production in December, 1950.

F-86D. General Electric J47-GE-17 (5,200 lb. = 2,360 kg. s.t.) in earlier production aircraft, and J47-GE-33 (7,650

The North American F-86F Sabre Fighter (General Electric J47 turbojet engine). (*Gordon Williams*).



The North American TF-86F, a Two-seat Trainer version of the F-86F. (*Gordon Williams*).

lb.=3,470 kg. s.t.) in current production, both engines with afterburners. All-weather interceptor. Air intake re-positioned under nose, which now encloses radar scanner. Larger rear fuselage to accommodate afterburner. All-flying tail. Equipment includes A.I., armament-laying and tracking, navigation and transponder radar, omni-range radio or Sperry Zero-Reader, ILS, automatic D/F, Lear auto-pilot and Hamilton Standard air-conditioning. Armament consists of 24 × 2.75 in. rockets which are carried in a retractable launching tray located in the underside of the fuselage. Overall length 41 ft. (12.5 m.). Other dimensions as for F-86E. Prototype flew on December 22, 1949. In production at Los Angeles.

On November 19, 1952, a standard F-86D with full combat load and piloted by Capt. J. Slade Nash, U.S.A.F., set up a World's Speed Record of 698.505 m.p.h. (1,124.137 km.h.). The record was made over a measured 3 km. course at Salton Sea, Cal., which is 240 ft. below sea level (Temp. 76°F.). On July 16, 1953, Lieut.-Col. W. F. Barns, U.S.A.F., also in an F-86D equipped for operational duty, increased the World's Speed Record to 715.697 m.p.h. (1,151.798 km.h.) over the same 3 km. course (Temp. 100.5°F.).

F-86E. One General Electric J47-GE-13 engine (5,200 lb.=2,360 kg. s.t.). Progressive development of F-86A. First version to have "flying tail," in which both tailplane and elevators controllable linked for co-ordinated movement. All controls power-operated and provided with artificial sensing system to give pilot a representative feel in absence of air loads. Irreversible control system also provided with a pressure-sensing unit which increases artificial feel force when longitudinal control is threatened by excessive loads on tail. In other respects similar to F-86A, which it followed on production line at Los Angeles in December, 1950. Production completed in April, 1952.

F-86F. One General Electric J47-GE-27 engine (5,800 lb.=2,630 kg. s.t.). Slightly larger and more powerful development of F-86E. Wing leading-edge extended forward 6 in. (15.2 cm.) at root and 3 in. (7.6 cm.) at tip, thus slightly increasing the angle of sweepback. Leading-edge slats eliminated and small fences added. First production F-86F flew on March 19, 1952. Still in production in 1955.

TF-86F. One General Electric J47-GE-27 engine (5,800 lb.=2,630 kg. s.t.). Two-seat trainer version of F-86F. Forward fuselage lengthened by 63 in. (1.6 m.) and wings moved forward 8 in. (20.3 cm.). Wing slats are fitted. Tandem seats under continuous canopy with instructor in rear cockpit. Complete dual controls and instrumentation. Provision for installation of two .50-cal. machine-guns and fittings provided under wings for the normal two 200 U.S. gallon drop tanks plus an additional pair of 120 U.S. gallon drop tanks or two practice bombs. All training equipment for basic missions supplied in kit form. First TF-86F flew for the first time on December 14, 1953, and was destroyed in an accident soon after. A second TF-86F was completed and flown in the Summer of 1954.

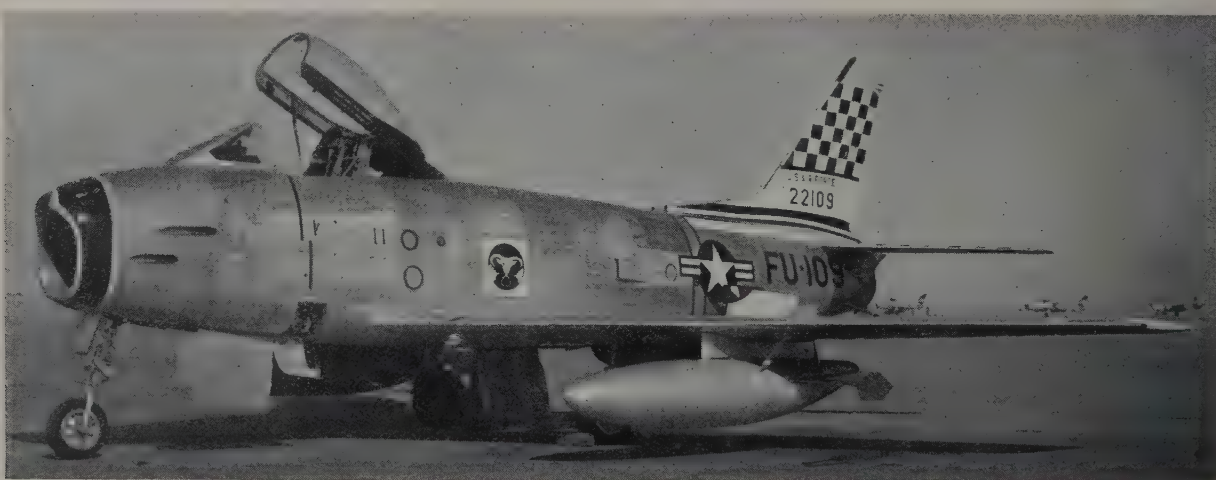
F-86H. General Electric J73-GE-3 engine (9,000 lb.=4,090 kg. s.t.). Fuselage 6 in. (15.2 cm.) deeper. First armed with six 0.50-in. guns but later with four 20 mm. M-34 cannon. Higher powered fighter-bomber version of F-86F, with larger tailplane without dihedral, electrically-operated flaps, hydraulically-operated speed brakes and controls, heavier landing-gear, improved suspension and release mechanism for carrying droppable wing tanks in conjunction with bombs and rockets. Clamshell-type canopy as in F-86D, improved ejector seat, etc. Two prototypes built at Los Angeles, the first making its maiden flight on April 30, 1953. In production at Columbus, Ohio. First production F-86H flew on September 4, 1953. At 1954 Dayton Air Show Major J. L. Armstrong, U.S.A.F. set new World's record over 500-km. closed circuit at 649.3 m.p.h. (1,038.8 km.h.), and Capt. E. P. Sonnenberg, U.S.A.F. won the Thompson Trophy Race over 100-km. closed course at 692.8 m.p.h. (1,108.4 km.h.), both flying an F-86H. Span: 37 ft. 1 in. (11.3 m.). Length: 38 ft. 9 in. (11.8 m.). Height: 15 ft. (4.57 m.).

F-86K. General Electric J47-GE-33 engine (5,600 lb.=2,540 kg. s.t.) with afterburner. Ordered by U.S.A.F. with M.D.A.P. funds for delivery to N.A.T.O. countries. Similar to F-86D but fitted with four 20 mm. cannon instead of rocket armament. Fuselage is 8 in. (20.3 cm.) longer than that of F-86D. Fifty to be assembled by Fiat in Italy from parts and assemblies supplied by N.A.A. First U.S.-built YF-86K flew on July 15, 1954.

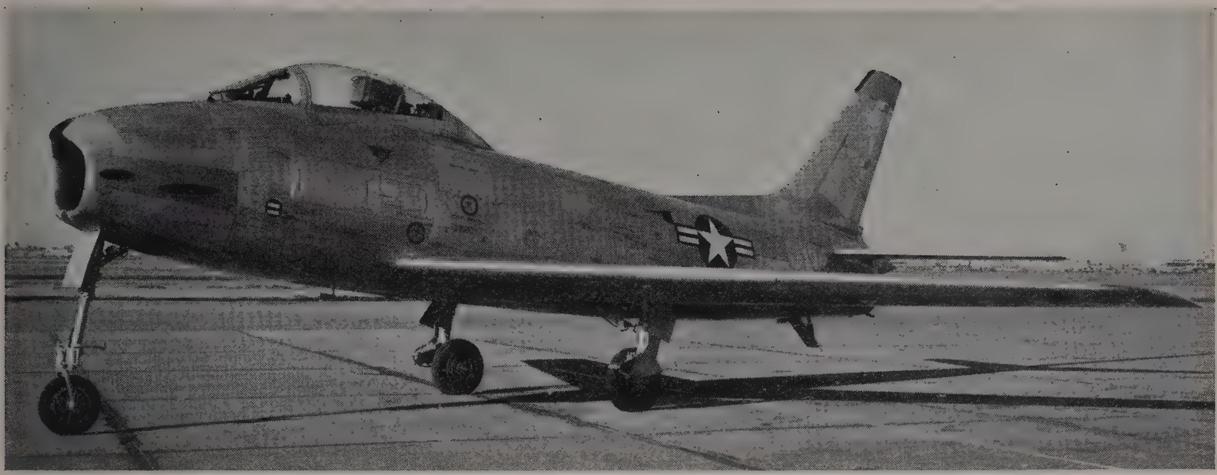
The description below refers to the F-86E.

Type.—Single-seat Fighter.

Wings.—Low-wing cantilever monoplane. NACA 0012-64 (root), 0011-64 (tip) laminar-flow wing section. Maximum thickness at 50% of chord. 35° sweepback along 25% chord line. All-metal two-spar structure with upper and lower skins, each of which is a sandwich consisting of two sheets milled to tapering thickness separated by "hat" section extrusions, the whole forming a torsion-box structure. Ailerons over 55% of half span, 24% of chord. 10° up and down deflection. Aileron hydraulic boost and artificial fuel system. Split flaps inboard of ailerons, 60° maximum



The North American F-86H Sabre, here seen with its current armament of four 20 mm. cannon.



The North American FJ-2 Fury Naval Fighter (General Electric J47 turbojet engine).

deflection. Leading-edge slots on outer 70% of span of each wing. Gross wing area 274 sq. ft. (25.4 m.²).

FUSELAGE.—Oval section all-metal structure with flush-riveted stressed skin. Air brakes on fuselage.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. All surfaces have 35° sweep-back. "Flying tail" in which elevators and tailplane are geared together and move differentially with movements of control column to provide in-flight trim. Column controls hydraulic valve which permits high-pressure fluid to flow into tailplane actuating cylinder. Artificial feel built in.

LANDING GEAR.—Retractable tricycle type with steerable nose-wheel. Hydraulic retraction. Cleveland 8657 air-oil shock struts. Bendix 26 in. (66 cm.) cast magnesium wheels and Bendix rotor-disc hydraulic brakes on main wheels. Track 8 ft. 3 in. (2.5 m.).

POWER PLANT.—One General Electric J47-GE-13 axial-flow turbojet (5,200 lb. = 2,360 kg. s.t.) with straight ram air entry in nose of fuselage. Nose entry lipped above to maintain adequate air flow in nose-up position. Main fuel tanks in fuselage. External long-range drop-tanks may be carried under wings outboard of landing-gear.

ACCOMMODATION.—Pressurised pilot's cockpit with sliding "bubble" canopy. Pilot ejection seat.

ARMAMENT.—Six 0.50-in. (12.7 mm.) machine-guns in nose. Provision for sixteen 5-in. (127 mm.) rockets under wings. May also carry 2 × 1,000-lb. or 2 × 2,000-lb. bombs in lieu of auxiliary tanks.

DIMENSIONS.—
Span 37 ft. 1 in. (11.3 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 14 ft. (4.27 m.).

LOADED WEIGHT.—
16,500 lb. (7,490 kg.).

PERFORMANCE.—
Max. speed over 670 m.p.h. (1,072 km.h.).
Service ceiling: 53,000 ft. (16,170 m.).
Tactical radius: 535 miles (856 km.).
Normal cruise range: 1,250 miles (2,000 km.).
Ferry range with external tanks: 2,350 miles (3,760 km.).

THE NORTH AMERICAN FURY.

U.S. Navy designation: FJ.

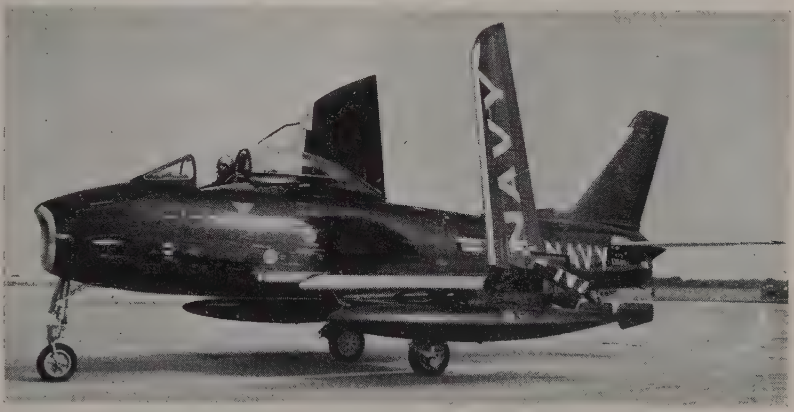
The latest version of the Fury is a single-seat swept-wing carrier fighter which is a naval development of the F-86 Sabre. It has the 35-degree swept wings and hydraulically-powered irreversible controls with artificial "feel" for the all-movable tail-unit, first introduced in the F-86E.

The landing-gear is similar to that of the Sabre but the nose-wheel unit is so designed that the normal nose-up static altitude can be increased for catapulting. Extension of the nose-wheel shock strut is by hydraulic means and is achieved by a manually-controlled selector valve which is operated by the carrier deck crew. When the landing-gear is retracted after take-off hydraulic fluid returns to the reservoir. The extendable nose-wheel strut increases the angle between the thrust line and deck from 4 to 8 degrees.

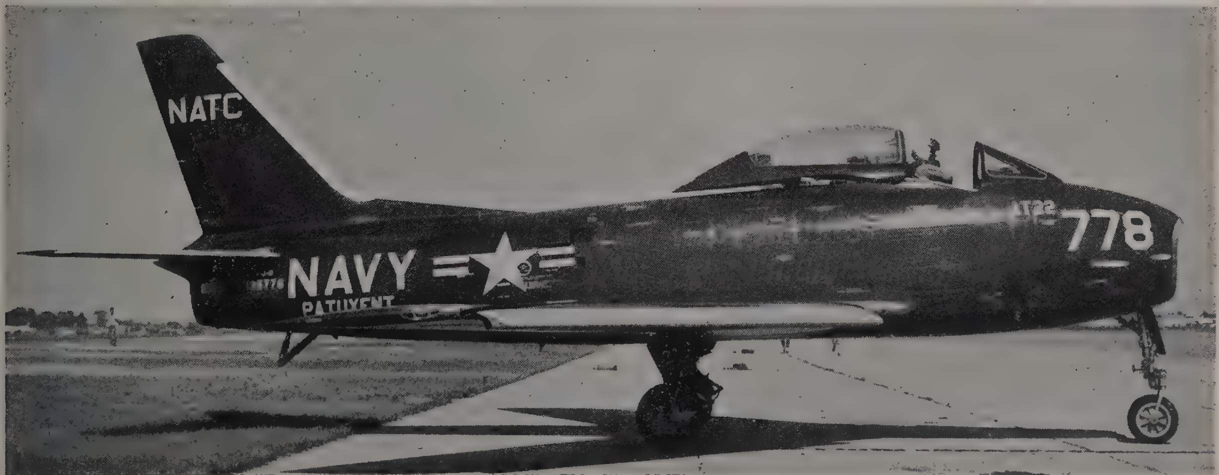
Armament consists of four 20 mm. cannon. A Navy gun-sight and an improved Navy ejection-seat are fitted.

The following versions of the swept-wing Fury have been announced :—

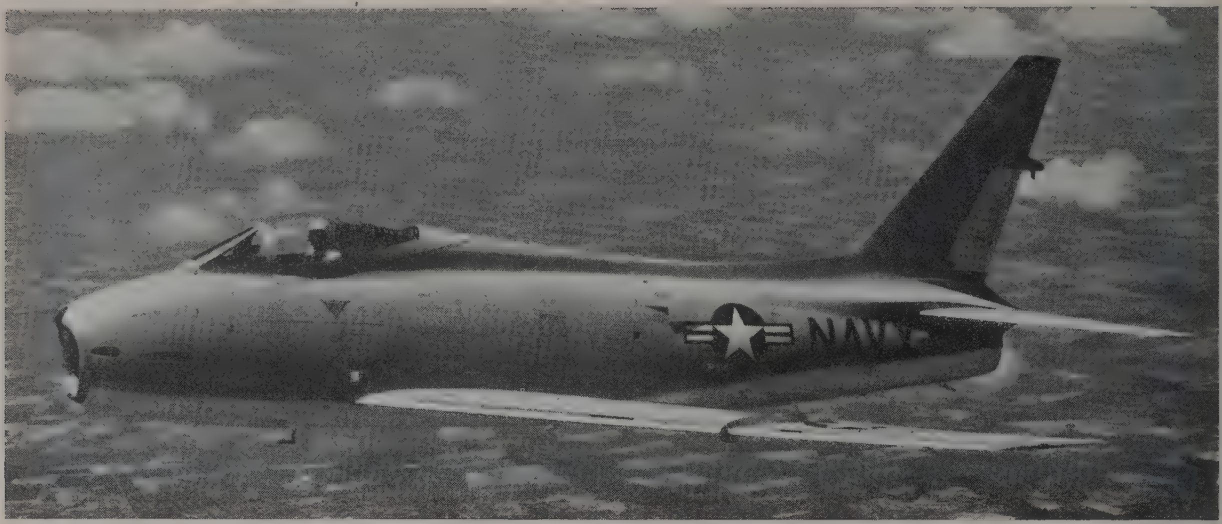
FJ-2. General Electric J47-GE-2 engine (5,270 lb. = 2,390 kg. s.t.). First production version. The prototype XFJ-2, which first flew on February 14, 1952, was a semi-navalised F-86E without



The North American FJ-3 Fury with wings folded. (*Levy-Shipp*).



The North American FJ-3 Fury Naval Fighter (Wright J65 turbojet engine). (*Gordon Williams*).



The North American FJ-4 Fury Naval Fighter (Wright J65 turbojet engine).

folding wings or armament. The cannon armament was first installed in the XFJ-2B, which was otherwise a standard F-86E. Produced at Columbus, Ohio, and in service with the U.S. Marine Corps.

FJ-3. Wright J65-W-2 engine (7,200 lb.=3,270 kg. s.t.). Larger and slightly heavier version of FJ-2 with enhanced performance. In production at Columbus, Ohio. XFJ-3 prototype flew for first time on July 3, 1953. A standard FJ-3 has climbed to 10,000 ft. (3,050 m.) from a standing start in 83 seconds.

FJ-4. Wright J65-W-4 engine (7,800 lb-=3,540 kg. s.t.). Improved version of FJ-3. New thin wing with mechanically-drooped leading-edge, slotted flaps and drooping split ailerons, new thinner-section all-moving tail, redesigned long-stroke landing-gear, addition of dorsal spine from fin to cockpit. First of two prototype FJ-4's flew on October 28, 1954.

Dimensions (FJ-3).—
Span 37 ft. 1 in. (11.3 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 13 ft. 8 in. (4.16 m.).

Dimensions (FJ-4).—
Span 39 ft. 1 in. (11.92 m.).
Length 37 ft. 6 in. (11.45 m.).
Weight 12 ft. 8 in. (3.86 m.).
Width folded 27 ft. 6 in. (8.38 m.).

Weights.—
Max. T.O. weight (FJ-3) over 18,000 lb. (8,170 kg.).
Max. T.O. weight (FJ-4) over 19,000 lb. (8,626 kg.).

THE NORTH AMERICAN SAVAGE.
U.S. Navy designation : AJ.

The Savage, a large composite-powered carrier-borne Attack Bomber capable of carrying an Atomic bomb, has been supplied to the U.S. Navy. The unusual power-plant of the Savage consists of two Pratt & Whitney R-2800 piston engines under the wings and a single Allison J33 turbojet in the rear fuselage. The turbojet gives added power when required for accelerated take-off or in combat. All the engines use the same type of fuel.

Two XAJ-1 prototypes were built, the first flying for the first time on July 2, 1948.

The following versions of the Savage have been revealed.

AJ-1. Two 2,400 h.p. Pratt & Whitney R-2800-44W piston engines and one Allison J33-A-10 turbojet (4,600 lb. = 2,090 kg.) s.t. Crew of three. First production AJ-1 flew in May, 1949. Now out of production. AJ-1's being converted into air tankers with Flight Refuelling "probe-drogue" equipment now standard in U.S. Navy. Pack comprising hose, drum, fuel pumps, electric power drive, drogue, etc., installed in bomb-bay, together with additional fuel capacity for tanker duties.

AJ-2. Development of AJ-1. Two Pratt & Whitney R-2800-48 piston engines and one Allison J33-A-10 turbojet engine. Higher vertical fin. Dihedral removed from tailplane. The first AJ-2 flew on February 19, 1953. Production completed in 1954.

AJ-2P. Photographic-reconnaissance version of AJ-2. 18 cameras for day and night photography at high and low altitudes. Photo-flash bombs in bomb-bay for night reconnaissance. Automatic control for most of cameras. Additional fuel capacity. Weight (approx.) 50,000 lb. (22,700 kg.). Maximum speed with jet power (approx.) 425 m.p.h. (680 km.h.). First AJ-2P flew on March 6, 1952. Production completed in 1954.

The general arrangement of the Savage can be gathered from the accompanying photographs. The outer wings fold inboard and the fin and rudder fold down on to the starboard tailplane. There is pressurised accommodation for a crew

North American AJ-2P Savage Photographic Reconnaissance Monoplanes of the U.S. Navy.

of three. No other details have been released for publication.

DIMENSIONS.—
Span 71 ft. 5 in. (21.77 m.).
Span (with wing-tip tanks) 75 ft. (22.87 m.).
Length 63 ft. 1 in. (19.22 m.).
Height (folded) 15 ft. 2 in. (4.62 m.).
Width (folded) 48 ft. (14.64 m.).

THE NORTH AMERICAN T-28.

The T-28 was originally designed for the U.S.A.F. as a replacement for the T-6 and it went into production for the U.S.A.F. in 1950 as the T-28A.

In 1952, following the policy of standardisation of training aircraft for all the services, the T-28 was adopted by the U.S. Navy and in modified form was put into production under the designation T-28B.

The two T-28 versions differ in the following respects :—

T-28A. 800 h.p. Wright R-1300-1 seven-cylinder radial engine and Aero Products two-blade constant-speed airscrew. U.S.A.F. advanced trainer. Out of production in 1953.

T-28B. 1,425 h.p. Wright R-1820 engine driving a three-blade Hamilton Standard constant-speed airscrew. U.S. Navy advanced trainer structurally similar to T-28A. New cockpit canopy, which was also introduced in later production T-28A's. Air brake on lower surface of fuselage. All training armament external with gun mounts, rocket and bomb racks under wings. Gunsight and camera in front cockpit. Re-arrangement of radio, electrical and oxygen equipment. Continues in production.

T-28C. Same as T-28B but equipped with arrester hook, etc. for operation from aircraft-carriers.

TYPE.—Two-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Two-spar all-metal structure. Trailing-edge flap between ailerons and fuselage. Total flap area 53.6 sq. ft. (4.98 m.^{2}). Gross wing area 268 sq. ft. (24.89 m.^{2}).

FUSELAGE.—All-metal semi-monocoque structure.

The North American T-28B Naval Advanced Trainer. *(Gordon Williams).*

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Area of fin and rudder 30.3 sq. ft. (2.81 m.^{2}), area of tailplane and elevators 59.7 sq. ft. (5.54 m.^{2}).

LANDING GEAR.—Retractable tricycle type. Main wheels with Goodyear single-disc brakes retract inwardly into wings, nose-wheel backwards into fuselage. United Aircraft Products air-oil shock struts. Nose wheel is steerable from either cockpit by electro-hydraulic boost control. Nose wheel also carries a movable taxi light. Main wheel track 12 ft. 8 in. (3.86 m.).

POWER PLANT (T-28A).— One Wright R-1300-1 seven-cylinder radial air-cooled engine with a military and take-off rating of 800 h.p. and a normal rating of 700 h.p. Aero Products two-blade constant-speed airscrew 10 ft. (3.05 m.) diameter. Fuel capacity 125 U.S. gallons (473 litres).

POWER PLANT (T-28B).—One 1,425 h.p. Wright R-1820 engine driving a three-blade Hamilton Standard constant-speed airscrew.

ACCOMMODATION.—Tandem cockpits beneath single bubble canopy. Duplicated flight controls and instruments. Amber screen blind and night flying equipment with ultra-violet and infra-red instrument lighting. Armament, gun-sight, radio, etc. easily installed and removed.

DIMENSIONS.—
Span 40 ft. 1 in. (12.23 m.).
Length 32 ft. (9.76 m.).
Height overall 12 ft. 8 in. (3.86 m.).

WEIGHTS AND LOADINGS (T-28A).—
Weight empty 5,111 lb. (2,320 kg.).
Normal loaded weight 6,365 lb. (2,890 kg.).
Max. take-off weight 6,759 lb. (3,068 kg.).
Wing loading 23.8 lb./sq. ft. (116.14 kg./m.^{2}).
Power loading 7.96 lb./h.p. (3.61 kg./h.p.).

WEIGHTS AND LOADINGS (T-28B).—
Weight empty 6,424 lb. (2,916 kg.).
Normal loaded weight 8,004 lb. (3,634 kg.).
Max. T.O. weight 8,486 lb. (3,853 kg.).
Normal wing loading 29 lb./sq. ft. (141.52 kg./m.^{2}).
Normal power loading 5.6 lb./h.p. (2.54 kg./h.p.).

PERFORMANCE (T-28A).—
Max. speed 285 m.p.h. (456 km.h.) at 5,900 ft. (1,800 m.).
Cruising speed 190 m.p.h. (304 km.h).
Stalling speed 72 m.p.h. (115.2 km.h.).
Initial rate of climb 2,030 ft./min. (628 m./min.).
Service ceiling 29,000 ft. (8,845 m.).
T.O. run to clear 50 ft. (15.25 m.) 570 yds. (521 m.).
Max. range 1,008 miles (1,612 km.).

PERFORMANCE (T-28B).—
Max. speed 346 m.p.h. (554 km.h.).
Cruising speed 310 m.p.h. (496 km.h.) at 30,000 ft. (9,150 m.).
Initial rate of climb 3,830 ft./min. (1,168 m./min.).
Service ceiling 37,000 ft. (11,285 m.).
T.O. run to clear 50 ft. (15.25 m.) 380 yds. (348 m.).
Max. range 1,060 miles (1,696 km.) at 10,000 ft. (3,050 m.).

NORTHROP

NORTHROP AIRCRAFT, INC.

HEAD OFFICE AND WORKS: HAWTHORNE, CALIFORNIA.

President and Chief Executive: Whitley C. Collins.

Vice-President, Finance: Roland J. Pagen.

Vice-President, Administration: John R. Alison.

Vice-President—Engineering: Edgar Schmued.

Vice-President—Manufacturing: Kenneth P. Bowen.

Vice-President and Executive Assistant to the President: Robert R. Miller.

Secretary and Corporation Counsel: George Gore.

Assistant Secretary: Alan C. Morgan.

Assistant Secretary (Washington, D.C.): S. W. Towle, Jr.

Assistant Secretary (Dayton, Ohio): Fred J. Baum.

Assistant Treasurer: Charles C. Cilley.

Northrop Aircraft, Inc. was formed in 1939 by John K. Northrop and others to undertake the design and manufacture of military aircraft.

During World War II the company produced the N3PB seaplane used by the Royal Norwegian Air Force and the P-61 Black Widow night fighter. It was also engaged in large-scale sub-contract work for other aircraft manufacturers.

During the war and for a short while after the company devoted considerable attention to the design and construction of "Flying Wing" type aircraft. Details of this work together with descriptions and illustrations of the various "Flying Wing" types built have appeared in previous editions of "All the World's Aircraft."

Northrop is now in production with the F-89 Scorpion all-weather interceptor fighter for the U.S.A.F. It is also engaged on several military projects of a secret nature.

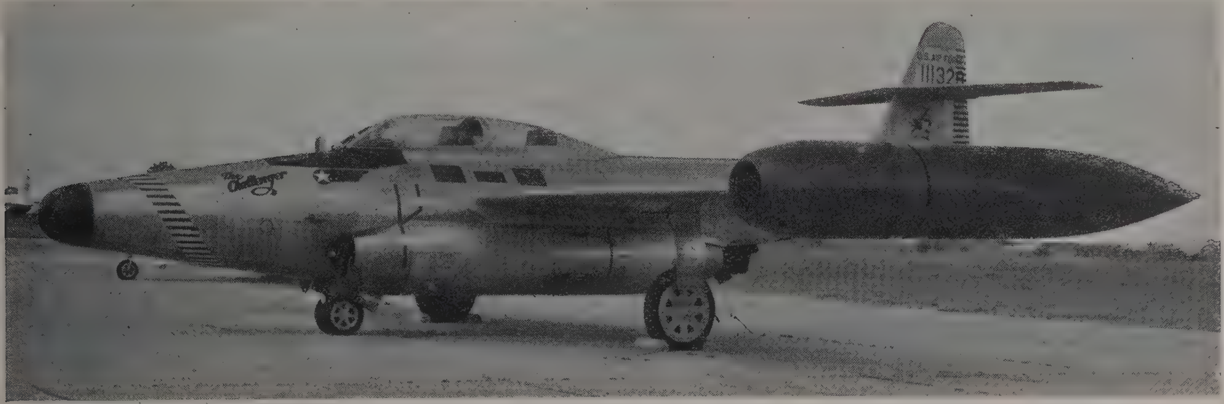
The Radioplane Company, of Van Nuys, California, designers and producers of radio-controlled target drones, is a wholly-owned subsidiary of Northrop. Details of some of the activities of the Radioplane Company will be found on page 305.

THE NORTHROP SCORPION.

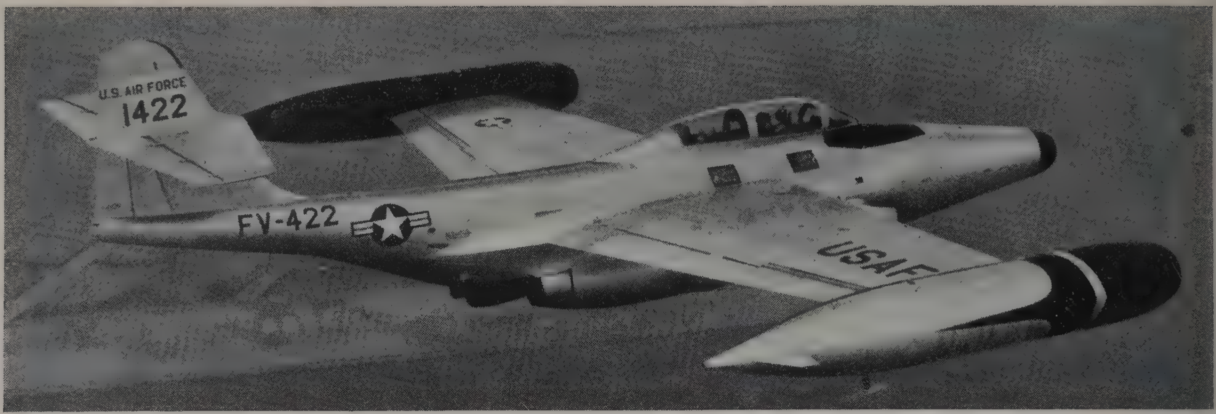
U.S. Air Force designation: F-89.

The following are the principal versions of the F-89 Scorpion :—

F-89A. Two Allison J35-A-21 engines (4,900 lb. = 2,225 kg. s.t. each) with after-burners. First production model. Armament consists of six nose-mounted 20 mm. cannon.



The Northrop F-89D Scorpion Two-seat All-weather Fighter (two Allison J35 turbojet engines). *(Olsen-Bodie).*



The Northrop F-89D Scorpion Two-seat All-weather Fighter (two Allison J35 turbojet engines).

F-89B. Two Allison J35-A-33 engines (5,000 lb. = 2,270 kg. s.t. each). Second production model. Generally similar to the F-89A but with certain internal and equipment changes.

F-89C. Two Allison J35-A-35 engines (5,600 lb. = 2,540 kg. s.t. each). Progressive development of F-89B. External mass-balances on elevators suppressed.

F-89D. Two Allison J35-A-35 engines (5,600 lb. = 2,540 kg. s.t. each) with Solar afterburners. Rocket-armament replaces the six 20 mm. nose-mounted cannon of earlier F-89 versions. A total of 104 2.75 in. folding-fin air-to-air rockets carried in permanently mounted wing-tip pods. Electronic aiming and automatic triggering equipment. Two droppable pylon-mounted underwing tanks equipped with Bohanan cartridge-type force ejectors for jettisoning. Additional fuel gives 11 per cent. increase in range as compared with F-89C.

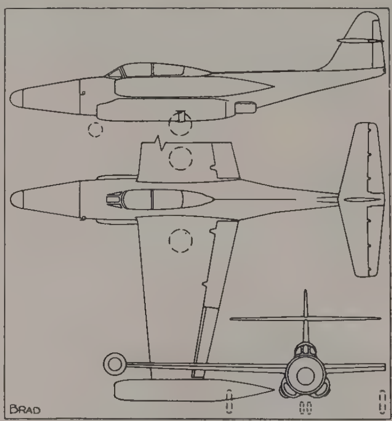
XF-89E. Experimental aircraft serving as test-bed for Allison J71 engine.

F-89H. Follows F-89D in production. To be armed with the Hughes GAR-1 Falcon air-to-air missile.

The following description refers to the F-89D.

TYPE.—Twin-engined two-seat All-weather Interceptor Fighter.

WINGS.—Low-wing cantilever monoplane. Thin-section high-lift low-drag wing-section. Thickness ratio 8½% at root, 7½% at tip. Taper ratio 2 : 1. Aspect ratio 4.5 : 1. Leading-edge sweep back 5°. All-metal multi-cellular structure. Double slotted flaps inboard of ailerons. The power-operated ailerons, or "decelerons," are split so as to serve as ailerons or dive-brakes. The upper and lower segments may be opened up and down simultaneously to serve as air brakes; or with the segments closed the surfaces operate as conventional ailerons. Hot-air anti-icing. Aileron area 45 sq. ft. (4.18 m.²). Flap area 63 sq. ft. (5.85 m.²). Gross wing area 562 sq. ft. (52.20 m.²).



The Northrop F-89D Scorpion.

FUSELAGE.—Oval section all-metal structure. Built in halves with joint along vertical centre-line, each half being equipped before assembly to central vertical keel which serves as mounting member for, and intervening firewall between, the two engines.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Power-operated control surfaces operated by aircraft hydraulic system, with emergency electrical actuation should hydraulic power fail. Tailplane span 11 ft. 6 in. (3.50 m.). Tailplane area 110 sq. ft. (10.22 m.²). Elevator area 25 sq. ft. (2.32 m.²). Vertical tail area (fin and rudder) 38 sq. ft. (3.53 m.²).

LANDING GEAR.—Retractable tricycle type. Main wheels are of large diameter and thin enough to permit total enclosure in wings when retracted. 165 lb./sq. in. tyre pressure. Hydraulic retraction.

POWER PLANT.—Two Allison J35 turbo-jet engines, each with a static (dry) thrust rating of 5,200 lb. (2,360 kg.). Solar after-burners with adjustable nozzles. Engines mounted one on each side of fore-and-aft fuselage keel low down and only partly within the fuselage contour. Engines may be lowered clear of mountings by built-in hydraulic hoist for ground level maintenance. Four lightweight Goodyear bullet-proof tanks in fuselage and twelve Goodyear Pliocel bladder tanks in wings. Under-wing pylon-mounted auxiliary fuel tanks with Bohanan cartridge type jettison equipment.

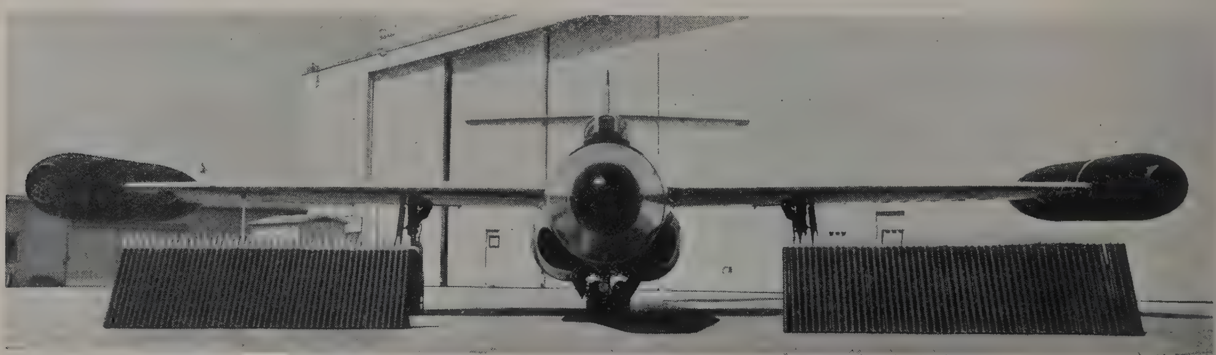
ACCOMMODATION.—Crew of two, pilot and radar operator, in tandem in pressurised cockpit. Power-operated jettisonable canopy and ejection seats. Cabin heating and refrigeration.

ARMAMENT.—All-rocket armament. 104 × 2.75 in. folding-fin air-to-air rockets carried in two wing-tip pods. Electronic aiming and triggering equipment. Rockets may be fired in groups or in volley.

DIMENSIONS.—
Span 59 ft. 8 in. (18.19 m.).
Length 53 ft. 4 in. (16.26 m.).
Height 17 ft. 7 in. (5.36 m.).

WEIGHTS.—
Loaded weight over 40,000 lb. (18,160 kg.).

PERFORMANCE.—
Max. speed over 600 m.p.h. (960 km.h.).
Operational ceiling over 50,000 ft. (15,250 m.).



The Northrop F-89D Scorpion Two-seat All-weather Fighter with its armament of 104 2.75-inch rockets.

PIASECKI

PIASECKI HELICOPTER CORPORATION.

HEAD OFFICE AND WORKS: MORTON, PENNSYLVANIA.

President: Don. R. Berlin.

Vice-President: Harry S. Pack.

Vice-President and Secretary: Wesley R. Frysztacki.

Vice-President, Engineering: L. L. Douglas

Vice-President, Manufacturing: William Davey.

Vice-President and Treasurer: Gareth W. Speer.

Controller: H. W. Lord.

Director of Procurement: John N. Eustis.

Director of Public Relations: H. S. Tremper.

The Piasecki Helicopter Corpn., known until 1946 as the P-V Engineering Forum, originated in August, 1940, when a discussion group of several engineers interested in the development of rotary-wing aircraft started meeting in their spare time.

Shortly after this group was formed it began design work on a small helicopter which was later built and designated the PV-2. This aircraft, first flown on April 11, 1943, was the second American helicopter to be flown publicly. It was illustrated and described in the 1945-46 edition of this Annual.

Since then the company has developed a number of successful tandem rotored

helicopters; the HRP and HUP series for the U.S. Navy, Royal Canadian Navy and the French L'Aéronavale; the H-25 for the U.S. Army, and the H-21 series for the U.S.A.F., U.S. Army and the R.C.A.F.

In February, 1950 the company was awarded a U.S.A.F. contract for a substantial quantity of YH-21 Arctic rescue helicopters, a development of the Navy HRP-2. Subsequent orders have been placed by the U.S.A.F. for the H-21A, and by the U.S.A.F. and the U.S. Army for the higher-powered H-21B and H-21C transport helicopters.

Currently in production are the H-21B and H-21C, while under development are the YH-16 and the YH-16A.

The U.S.A.F. contract for the XH-16 and XH-16A involves the development of an extremely large utility transport tandem helicopter for the U.S.A.F. and U.S. Army for troop and cargo transport duties. The first unit, the YH-16, a dynamic test article, made its first flight on October 23, 1953. Since then the Transporter has made many test flights, during one of which it reached a speed of over 100 m.p.h. (160 km.h.). Tie-down endurance testing was completed in 1954 and flight testing has continued into 1955. A second unit, the YH-16A, powered by two shaft turbine engines, was completed in 1954, and was scheduled to begin flight testing in 1955.

Mr. Frank N. Piasecki, founder of the company and its chairman until May, 1955, has formed a new company called the Piasecki Aircraft Corporation, although at the time of writing he still held 25% of the stock of Piasecki Helicopter Corporation. Mr. Piasecki's new company will engaged in research and development in all phases of vertical take-off aircraft.

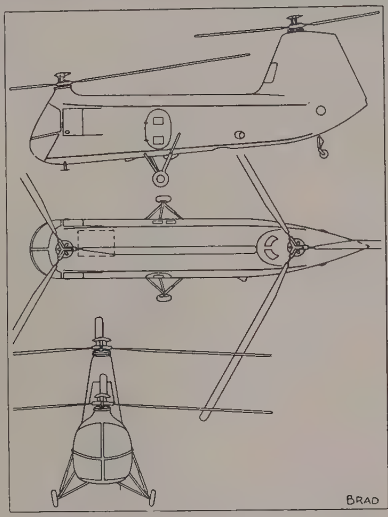
The Piasecki HUP-2 Retriever Naval Helicopter.

THE PIASECKI PD-18.

U.S. Navy designation: HUP Retriever.
U.S. Army designation: H-25A Army Mule.

This single-engined tandem-rotored helicopter was designed to meet the requirements of the U.S. Navy for shipboard operation, including carrier plane guard duty, rescue, observation and inter-ship and ship-to-shore utility transport duties. It was required to negotiate the smallest aircraft-carrier lift without blade folding and to go down a standard cruiser aircraft lift with blades folded.

After completing an extensive Navy evaluation programme the prototype XHJP-1 was adopted by the U.S. Navy as a Fleet helicopter and a production order for twenty-two, under the designation HUP-1, was awarded to the company. Subsequently additional orders have been placed for the HUP-1 and the higher-powered HUP-2 by the U.S. Navy, the Royal Canadian Navy and the French Navy, and for the H-25A by the U.S. Army.



The Piasecki HUP-2.

The HUP helicopter has an all-metal soundproofed fuselage with a normal accommodation for a crew of two and four passengers or three stretcher cases. A large loading door and ample cabin dimensions also permit the transport of a wide variety of high or low density cargo. An internally-operated rescue hatch adjacent to the pilot's seat is large enough to allow the passage of a loaded stretcher. A hydraulically-operated hoist above the hatch is used for hoisting survivors while hovering, and if a rescue sling is used the pilot can conduct the entire loading operation without assistance.

The 339th and last HUP was delivered to the U.S. Navy on July 1, 1954. The several versions of this helicopter which are in service are identified below.

HUP-1. 525 h.p. Continental R-975-34 engine. First production model. Deliveries started in 1950 and were completed in 1952.

HUP-2. 525 h.p. Continental R-975-46 engine. As the result of successful trials in automatic control in all flight conditions with the prototype XHJP-1, using a modified Sperry automatic pilot, all production HUP-2's have an auto-pilot as primary controller. This permits the elimination of the tail stabilising surfaces used in the HUP-1. Fitted with submarine-hunting sonar equipment, the HUP-2S was the first interim anti-submarine warfare helicopter to go into service. First deliveries began in 1952. HUP-2 also used for plane guard, rescue and utility duties. Deliveries completed in 1954.

HUP-3. Medical evacuation and light cargo helicopter. U.S. Navy version of the Army H-25A.

H-25A. U.S. Army version of HUP-type. Incorporates hydraulic boost on all controls, strengthened all-metal cabin floor with cargo tie-down fittings and special modifications to facilitate loading and unloading of stretcher patients. Deliveries began in 1953 and were completed in 1954.

HUP-4. 700 h.p. Wright R-1300-3 engine. This aircraft is the result of a two-phase Naval programme to increase the all-round performance of the HUP-2. First phase called for the installation of the higher-powered R-1300-3 engine, but with its normal power de-rated to 600 h.p. The second phase called for a re-design of the transmission to permit the full power of 700 h.p. to be used. The HUP-4 re-design is such that all modifications can be incorporated in existing HUP-2, HUP-3 and H-25A helicopters now in service.

The following data specifically concerns the HUP-2 and H-25A.

Dimensions.—
- Length (rotors turning) 56 ft. 11 in. (17.3 m.).
- Length of fuselage (blades folded) 32 ft. (9.75 m.).
- Width (rotors turning) 35 ft. (10.7 m.).
- Width (blades folded) 12 ft. 11 in. (3.91 m.).
- Height (HUP-2) 13 ft. 2 in. (4.0 m.).
- Height (H-25A) 12 ft. 6 in. (3.8 m.).

Weights.—
- Empty (HUP-2) 4,132 lb. (1,874 kg.).
- Empty (H-25A) 3,928 lb. (1,782 kg.).
- Normal loaded weight 5,750 lb. (2,608 kg.).
- Max. overloaded weight 6,100 lb. (2,767 kg.).

The Piasecki H-25A Army Mule Military Helicopter.

The Piasecki H-21A Work Horse Arctic Rescue Helicopter (1,150 h.p. Wright R-1820 engine).

PERFORMANCE.—
- Max. speed at S/L. (normal power) over 105 m.p.h. (170 km.h.).
- Cruising speed over 80 m.p.h. (130 km.h.).
- Best rate of climb (normal power) 1,000 ft./min. (305 m./min.).
- Vertical rate of climb (take-off power) 650 ft./min. (198 m./min.).
- Service ceiling over 10,000 ft. (3,050 m.).
- Max. range approx. 340 miles (630 km.).

THE PIASECKI PV-3 and PV-17 RESCUER.
U.S. Navy designation: HRP-1 and HRP-2.

The HRP-1 was the first large tandem-rotored transport helicopter to be put into production by Piasecki. The prototype XHRP-1 (PV-3) was first flown in March, 1945, and twenty HRP-1 helicopters were delivered to the U.S. Navy in 1948. A refined all-metal version, the HRP-2 (PV-17), was developed subsequently and deliveries were made to the U.S. Marine Corps in 1950. Details of the HRP-1 and the HRP-2 were described in the 1953-54 edition of this Annual. Air Force evaluation of the HRP-2 was instrumental in selection of the higher-powered H-21 as the winner of a design competition for an Arctic rescue helicopter.

THE PIASECKI PD-22 WORK HORSE.
U.S.A.F. and Army designation: H-21.

This higher powered version of the HRP-2 has been supplied to the U.S.A.F., U.S. Army and the Royal Canadian Air Force. It exists in the following versions :

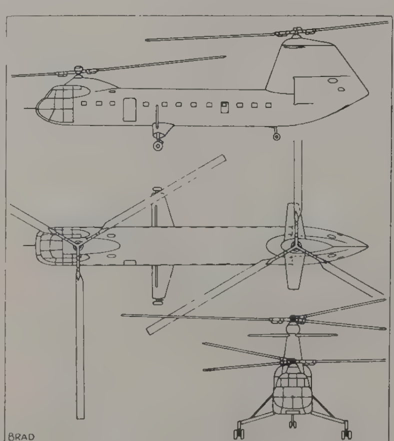
YH-21 and H-21A. One Wright R-1820-103 engine with power limited to 1,150 h.p. Arctic rescue helicopter. Passenger-cargo compartment 20 ft. (7.1 m.) long, 5 ft. 8 in. (1.73 m.) wide and 5 ft. 6 in. (1.68 m.) high. Crew of two, pilot and co-pilot (or medical attendant), and accommodation for twelve stretchers or fourteen troops. 400 lb. (182 kg.) capacity swinging boom-type hydraulic hoist above large sliding door immediately behind pilot on starboard side for transferring loads while hovering, and further door on port side aft for loading and unloading on gound. Each wheel of fixed landing-gear surrounded with inflatable ring floats to permit landing on water, marsh and land. Equipment includes cabin insulation and heating, blind-flying instruments, hydraulic control boost, external cargo sling, pilot-controlled searchlight, fixed landing light, tie-down cargo fittings in cabin floor, troop seats and stretcher supports. The Arctic Rescue version of the H-21 has demonstrated its ability to operate at temperatures down to minus 65°F.

H-21B and H-21C. One 1,425 h.p. Wright R-1820-103 engine. Troop and cargo transport capable of performing assault airlift, transport of troops and equipment, and rescue and evacuation missions for U.S. Air Force and Army. Interior and exterior dimensions and crew accommodations same as for H-21A. Cabin accommodates twelve stretchers or twenty troops. Forward door and swinging boom hoist as for H-21A but rear door larger and two extra windows added. Equipment same as for H-21A except for additional items which include autopilot, provision for jettisonable auxiliary fuel tanks, bullet-sealing fuel and oil tanks, readily-removable armour kit for protection of vital components, etc.

The following data apply to the commercial version of the H-21B and C. This version (commercial designation PH-42) will have accommodation for a crew of two and twenty passengers in troop seats or 16-19 passengers in airline seats. It was hoped to get CAA certification for the PH-42 by the end of March, 1956.

DIMENSIONS.—
- Rotor diameter 44 ft. 6 in. (13.37 m.).
- Overall length (rotors turning) 86 ft. 4 in. (26.24 m.).
- Width (blades folded) 14 ft. 2 in. (4.31 m.).
- Overall height 15 ft. 5 in. (4.68 m.).
- Main landing gear tread 13 ft. 4 in. (4.05 m.).
- Passenger cabin length 20 ft. 0 in. (6.08 m.).
- Passenger cabin width 5 ft. 8 in. (1.72 m.).
- Passenger cabin height 5 ft. 6 in. (1.67 m.).

WEIGHTS.—
- Weight empty (standard equipment) 8,000 lb. (3.629 kg.).



The Piasecki YH-16 Transporter.

- Normal useful load 5,300 lb. (2,404 kg.).
- Normal loaded weight 13,300 lb. (6,033 kg.).

PERFORMANCE (at normal A.U.W.).—
- Max. speed at S/L. 131 m.p.h. (211 km.h.).
- Cruising speed at S/L. (for best range) 98 m.p.h. (158 km.h.).
- Max. rate of climb (normal rated power) 1,080 ft./min. (330 m./min.).
- Vertical rate of climb (take-off power) 900 ft./min. (276 m./min.).
- Hovering ceiling in ground effect (take-off power) 6,160 ft. (1,880 m.).
- Hovering ceiling out-of-ground effect (take-off power) 5,600 ft. (1,710 m.).
- Service ceiling 9,450 ft. (2,880 m.).

PERFORMANCE (at 11,500 lb.=5,216 kg. A.U.W.).—
- Useful load 3,582 lb. (1,625 kg.).
- Vertical rate of climb 1,700 ft./min. (516 m./min.).
- Hovering ceiling out-of-ground effect about 10,000 ft. (3,050 m.).
- Service ceiling 15,700 ft. (4,790 m.).

THE PIASECKI PV-15 TRANSPORTER.
U.S.A.F. designations: YH-16 and YH-16A.

The YH-16 40-passenger twin-engined helicopter has been designed and built for the U.S.A.F.

A contract for two YH-16's was placed in June, 1949. The YH-16, a dynamic test vehicle, powered by two 1,650 h.p. Pratt & Whitney R-2180-11 engines flew on October 23, 1953, but was under-powered. The second helicopter, the YH-16A has two Allison T38-A-6 shaft turbines of nearly 3,000 s.h.p. each. It was completed in 1954 and by the Spring of 1955 all pre-flight tied-down testing had been completed. Flight-testing was due to start later in 1955.

The transmission and the whole dynamic system, including the blades, of the YH-16 were designed to absorb a maximum of 1,800 h.p., consequently the whole system had to be redesigned for the more powerful engines of the YH 16A.

The engine installation of the YH-16A is now regarded as transitional and plans call for the subsequent use of two Allison T56 shaft turbines of some 4,000 s.h.p. The first prototype YH-16 is now being modified and re-engined with the higher-powered T56 shaft turbines and will be redesignated YH-16B.

Each rotor is driven by an engine installed below and the two transmission assemblies are connected by a shaft along the top of the fuselage so that if one engine fails the other can drive both rotors.

In addition to its 40 passengers the helicopter will carry a normal crew of three. The flight compartment can

The Piasecki YH-16 Transport Helicopter (two 1,650 h.p. Pratt & Whitney R-2180 engines).

accommodate pilot and co-pilot as well as a flight engineer or navigator.

In addition to a conventional loading door at the forward end of the large cabin, the YH-16 has a ramp at the rear end which can be lowered for the fast loading and unloading of passengers, cargo or stretcher patients. The cabin can be arranged to carry 32 stretcher cases in lieu of the 40 seated passengers.

Outside the forward cabin door there is a pilot-operated cable hoist to permit loading and unloading over water or terrain on which the helicopter cannot land.

DIMENSIONS.—
Rotor diameter 82 ft. (25 m.).
Overall length (rotors turning) 134 ft. (40.9 m.).
Length of fuselage 78 ft. (23.8 m.).
Height 25 ft. (7.6 m.).

DESIGNED GROSS WEIGHT.—
Over 30,000 lb. (13,608 kg.).

PERFORMANCE (Designed).—
Max. speed over 125 m.p.h. (200 km.h.).
Service ceiling over 18,000 ft. (5,490 m.).
Range more than 200 miles (322 km.).

PIPER

THE PIPER AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: LOCK HAVEN, PENNSYLVANIA.

President and Chairman of the Board: W. T. Piper, Sr.

Executive Vice-President: W. T. Piper, Jr.

Vice-President in charge of Operations: Thomas F. Piper.

Vice-President in charge of Research and Development: Howard Piper.

Chief Engineer: W. C. Jamouneau.

The Piper Aircraft Corporation is now manufacturing the PA-23 Apache, a twin-engined executive aircraft for four passengers, the PA-22 Tri-Pacer, the Super Cub 95 and 150, and the PA-18-A agricultural version of the Super Cub 150. The PA-20 Pacer with tail-wheel landing-gear has been discontinued and is no longer available. The 1955 Super Cub 150, PA-18-A and PA-22 Tri-Pacer are all powered with the 150 h.p. Lycoming O-320 engine instead of the 135 h.p. Lycoming O-290 engine.

Sub-contracting activities include considerable work for both jet aircraft and helicopter manufacturers.

Piper Aircraft Corporation still leads in World sales of light aircraft.

THE PIPER PA-23 APACHE.

TYPE.—Four-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. U.S.A. 35-B (modified) wing section. Aspect ratio 6.8. Chord 5 ft. 7 in. (1.70 m.). Dihedral 5°. All-metal structure. Frise type all-metal ailerons and flaps. Total aileron area 8.375 sq. ft. (0.77 m.²). Gross wing area 204 sq. ft. (18.95 m.²).

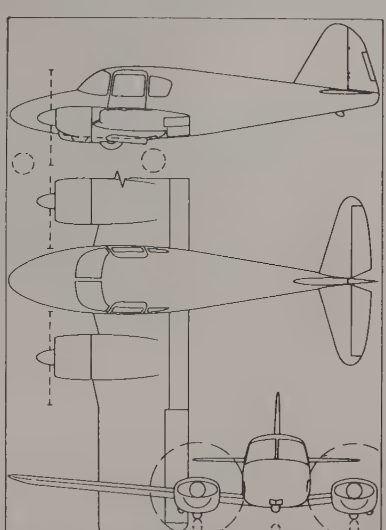
FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal. Areas: fin 10.75 sq. ft. (1.00 m.²), rudder 9.75 sq. ft. (0.90 m.²), elevators (total) 18.6 sq. ft. (1.72 m.²), tailplane 18.6 sq. ft. (1.72 m.²).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction. Electrol hydraulic shock-absorber struts. Goodrich wheels. Hydraulic brakes. Wheelbase 7 ft. 6 in. (2.28 m.). Track 11 ft. (3.35 m.).

POWER PLANT.—Two 150 h.p. Lycoming O-320 six-cylinder horizontally-opposed air-cooled engines. Hartzell two-blade constant-speed full-feathering airscrews, 6 ft. 4 in. (1.93 m.) diameter. Two rubber-cell fuel tanks, one in each wing. Total fuel capacity 72 U.S. gallons (272 litres).

ACCOMMODATION.—Enclosed cabin seating four in two pairs, with dual controls to front pair. Full instrumentation. Omni radio, VHF, LF and automatic D/R equipment.



The Piper Apache.

DIMENSIONS.—
Span 37 ft. (11.28 m.).
Length 27 ft. 1 in. (8.25 m.).
Height 9 ft. 5 in. (2.87 m.).

WEIGHTS AND LOADINGS.—
Weight empty 2,180 lb. (990 kg.).
Passengers (4) 680 lb. (309 kg.).
Fuel and oil 464 lb. (210 kg.).
Baggage 176 lb. (81 kg.).
Weight loaded 3,500 lb. (1,590 kg.).
Wing loading 17.2 lb./sq. ft. (83.94 kg./m.²).
Power loading 11.6 lb./h.p. (5.26 kg./h.p.).

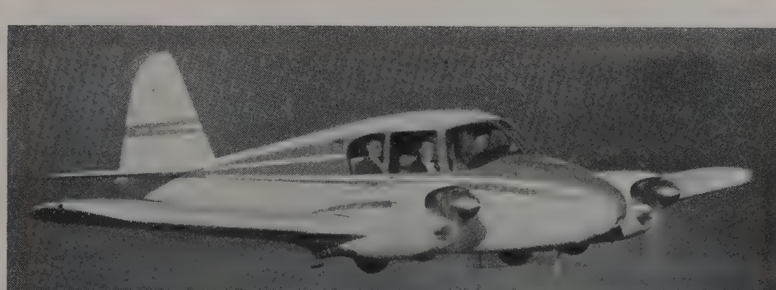
PERFORMANCE.—
Max. speed 180 m.p.h. (288 km.h.).
Cruising speed at 6,000 ft. (1,830 m.) 170 m.p.h. (272 km.h.).
Stalling speed (wheels and flaps down) 52 m.p.h. (83 km.h.).
Initial rate of climb 1,350 ft./min. (412 m./min.).
Rate of climb on one engine 240 ft./min. (93 m./min.).
Absolute ceiling 20,000 ft. (6,100 m.).
Single-engine ceiling 6,750 ft. (2,060 m.).
Cruising range 840 miles (1,345 km.).
Take-off run 900 ft. (275 m.).
Landing run 670 ft. (204 m.).

THE PIPER SUPER CUB 95.

U.S. Army designation: L-18.

TYPE.—Two-seat Light Cabin monoplane.

WINGS.—High-wing braced monoplane. Wing structure of aluminium spars and aluminium-alloy ribs, the whole being covered



The Piper Apache (two 150 h.p. Lycoming O-320 engines).

with Duroclad. Steel-tube Vee bracing struts. No flaps. Gross wing area 178.5 sq. ft. (16.58 m.^{2}).

Fuselage.—Rectangular welded steel-tube structure covered with Duroclad.

Tail Unit.—Braced monoplane type. Welded steel-tube framework covered with Duroclad. Tailplane span 9 ft. 6 in. (2.89 m.).

Landing Gear.—Fixed divided type. Two side Vees and half axles hinged to cabane below fuselage. Rubber cord shock absorption. Hydraulic wheel-brakes. Leaf-spring steerable tail-wheel.

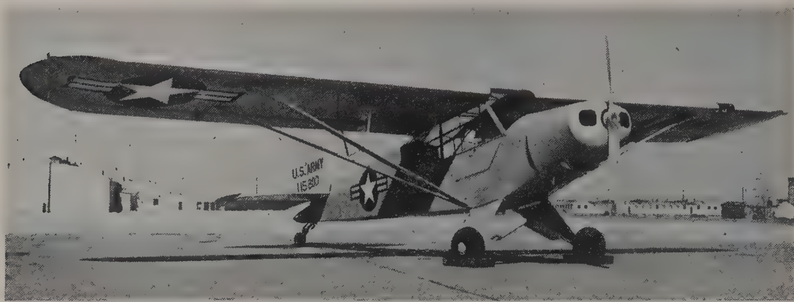
Power Plant.—One 90 h.p. Continental C90-8F four-cylinder horizontally-opposed air-cooled engine on swinging engine mounting. Two-blade fixed-pitch wood airscrew 6 ft. 2 in. (1.8 m.) diameter. Fuel capacity 18 U.S. gallons (68 litres).

Accommodation.—Enclosed cabin seating two in tandem with dual controls. Large door on right side and sliding windows on left. Baggage compartment aft of rear seat. Equipment may be installed for spraying, dusting, fertilising, etc.

Dimensions.—
- Span 35 ft. 2½ in. (10.72 m.).
- Length 22 ft. 4½ in. (6.82 m.).
- Height 6 ft. 7 in. (2.00 m.).

Weights and Loadings.—
- Weight empty 800 lb. (363 kg.).
- Disposable load 700 lb. (317 kg.).
- Weight loaded 1,500 lb. (680 kg.).
- Wing loading 8.4 lb./sq. ft. (50 kg./m.^{2}).
- Power loading 16.6 lb./h.p. (7.53 kg./h.p.).

The Piper PA-18 Super Cub 150 (150 h.p. Lycoming O-320 engine).



The Piper L-21A, the military liaison version of the Super Cub 150.

Performance.—
- Max. speed 112 m.p.h. (179 km.h.).
- Cruising speed 100 m.p.h. (160 km.h.).
- Stalling speed 42 m.p.h. (67.2 km.h.).
- Rate of climb 710 ft./min. (216 m./min.).
- Service ceiling 15,750 ft. (4,800 m.).
- T.O. run 390 ft. (119 m.).
- T.O. to 50 ft. (15.25 m.) 750 ft. (228 m.).
- Landing run 385 ft. (117 m.).

THE PIPER SUPER CUB 150.
U.S. Army designation: L-21A.

The 1955 Super Cub 150 is identical to the previously-described model except that it is fitted with a 150 h.p. Lycoming O-320 engine, has increased fuel capacity (36 U.S. gallons=136 litres) and has wing flaps.

All versions of the Super Cub may be fitted with Edo floats; and a range of optional equipment is available including electrical system, radio, wood or metal airscrew, extra fuel tank, etc.

Dimensions.—
- Same as for Super Cub 95 except:
- Length 22 ft. 6 in. (6.86 m.).

Weights and Loadings.—
- Weight empty 930 lb. (422 kg.).
- Disposable load 820 lb. (372 kg.).
- Weight loaded 1,750 lb. (794 kg.).
- Wing loading 10 lb./sq. ft. (48.8 lb./m.^{2}).
- Power loading 11.6 lb./h.p. (5.26 lb./h.p.).

Performance.—
- Max. speed 130 m.p.h. (208 km.h.).
- Cruising speed (75% power) 115 m.p.h. (184 km.h.).
- Stalling speed (with flaps) 43 m.p.h. (68.8 km.h.).
- Best rate of climb 725 ft./min. (220 m./min.).
- Service ceiling 19,000 ft. (5,795 m.).
- Take-off run 200 ft. (61 m.).

The Piper L-18B, a military liaison version of the Super Cub 95.

- Take-off distance to 50 ft. (15.25 m.) 500 ft. (152.5 m.).
- Landing run 350 ft. (107 m.).
- Cruising range 460 miles (735 km.).

THE PIPER PA-18-A.

This version of the Super Cub is primarily an agricultural sprayer/duster, but it is adaptable for normal uses. It is quantity produced with Piper designed and installed agricultural dispersal equipment as an integral part of the aircraft.

The fuselage has been modified to accommodate an 18 cub. ft. aluminium tank which has a capacity for 110 U.S. gallons of liquid or from 500 to 1,000 lb. of solids, depending on the specific gravity of material used. Every unit has a maximum output of 35 gallons per minute and a pressure range of from 10 to 110 lb., depending on the nozzle orifice and pressure regulator setting.

For dust distribution, an agitator in the hopper and, below the fuselage, a slotted venturi with double gates and lateral dispersal plates ensure uniform flow over a 50 ft. swath.

The normal spray booms are fitted with 24 diaphragm type nozzles which give instant positive shut-off. The booms are hinged to fold back and up about 80° to reduce impact loads if they hit an obstacle.

A new Piper high-density sprayer is also available which will permit the application of from 1 to 10 gallons per acre for a full 50 ft. swath, or 10 to 15 gallons if the swath is cut to 33 ft. This equipment incorporates 46 nozzles on the boom, a new large Simplex pump mounted under the nose cowling and larger outlet and return pipes from the tank to the pump. This high-density unit was designed primarily for de-foliating irrigated cotton and now has many new uses.

Safety features include sharpened leading-edges on the landing-gear struts to cut wires, etc., heavy duty safety belt and shoulder harness for the pilot, etc.

The 1955 PA-18-A is powered by the 150 h.p. Lycoming O-320 engine.

The Piper PA-18-A Agricultural Duster and Sprayer.

Weights and Loadings (Sprayer or Duster).—
- Weight empty 960 lb. (436 kg.).
- Disposable load 1,110 lb. (504 kg.).
- Weight loaded (max. permissible) 2,070 lb. (940 kg.).
- Wing loading 11.6 lb./sq. ft. (56.6 kg./m.^{2}).
- Power loading 13.8 lb./h.p. (6.62 kg./h.p.).

Performance (at 2,070 lb. = 940 kg. A.U.W.).—
- Max. speed 128 m.p.h. (205 km.h.).
- Cruising speed (75% power) 113 m.p.h. (181 km.h.).
- Stalling speed (flaps down) 45 m.p.h. (72 km.h.).
- Rate of climb 760 ft./min. (232 m./min.).

Service ceiling 17,000 ft. (5,185 m.).
Take-off distance to 50 ft. (15.25 m.) 950 ft. (290 m.).
Landing distance from 50 ft. (15.25 m.) 875 ft. (267 m.).

THE PIPER PA-22 TRI-PACER.

TYPE.—Four-seat Cabin monoplane.

WINGS.—High-wing braced monoplane. Wing structure consists of two I-section aluminium spars, riveted Nicral ribs and a covering of Duraclad, a non-inflammable Butyrate-plastic-treated fabric of high-gloss finish. Flaps inboard of ailerons. Wing area 147.5 sq. ft. (13.7 m.^{2}).

FUSELAGE.—Rectangular welded steel-tube structure covered with Duraclad.

TAIL UNIT.—Braced monoplane type. Same structure as for PA-18.

LANDING GEAR.—Fixed nose-wheel type. Two side Vees and half axles hinged to centre-line of underside of fuselage. Rubber cord springing. Hydraulic wheel brakes. Steerable nose-wheel interconnected with rudder for ground steering. Certified for floats and skis.

POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine. Two-blade Aeromatic or Sensenich metal fixed-pitch airscrew. Fuel capacity 36 U.S. gallons (136 litres).

ACCOMMODATION.—Cabin seats four in two pairs with dual controls to front pair. Front and rear doors, front door on starboard side and rear door on port side. Soundproofing, cabin heating and temperature control. Ultra-violet-absorbing Plexiglas windows. Large baggage compartment. Cabin equipment varies according to model. Narco two-way VHF and LF radio or automatic direction-finding and omni equipment in Custom model.

The Piper PA-22 Tri-Pacer (150 h.p. Lycoming O-320 engine).

DIMENSIONS.—
Span 29 ft. 4 in. (8.9 m.).
Length 20 ft. 4 in. (6.2 m.).
Height 6 ft. 2½ in. (1.98 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,100 lb. (500 kg.).
Disposable load 900 lb. (408 kg.).
Weight loaded 2,000 lb. (908 kg.).
Wing loading 13.5 lb./sq. ft. (65.88 kg./m.^{2}).
Power loading 13.3 lb./h.p. (6.03 kg./h.p.).

PERFORMANCE.—
Max. speed 139 m.p.h. (222 km.h.).
Cruising speed (75% power at S/L.) 123 m.p.h. (197 km.h.).
Optimum cruising speed (75% power at 7,000 ft.=2,135 m.) 132 m.p.h. (211 km.h.).
Stalling speed (flaps extended) 49 m.p.h. (78.4 km.h.).
Rate of climb at S/L. 725 ft./min. (221 m./min.).
Service ceiling 15,000 ft. (4,575 m.).
Absolute ceiling 17,500 ft. (5,340 m.).

RADIOPLANE

RADIOPLANE COMPANY (Subsidiary of Northrop Aircraft, Inc.).

HEAD OFFICE: 8000, WOODLEY AVENUE, VAN NUYS, CALIFORNIA.

President: Whitley C. Collins.

Executive Vice-President: William Larrabee.

Vice-President, Assistant to President: Ferris M. Smith.

Vice-President, Operations: M. W. Tuttle.

Vice-President, Contracts: H. E. Riggins, Jr.

Assistant Vice-President, Military Relations: A. W. Callam.

Assistant Vice-President, Engineering: William Patterson.

Director of Weapon Systems: S. E. Weaver.

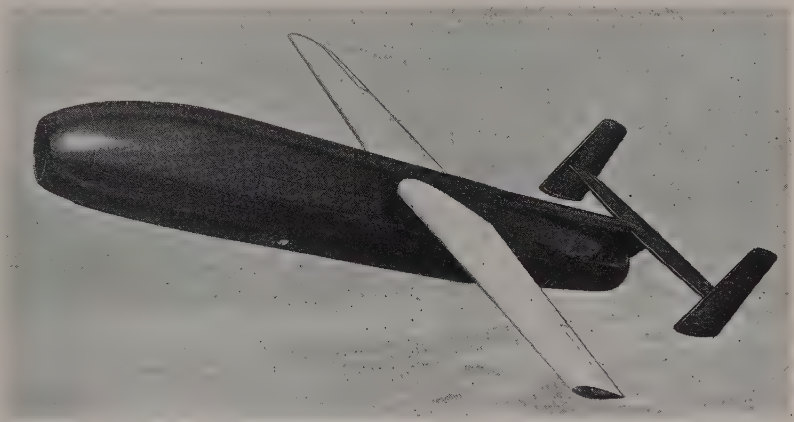
Chief Engineer: John R. Jacobsen.

Treasurer: Dan H. Hill.

The Radioplane Company, a wholly-owned subsidiary of Northrop Aircraft, Inc. manufactures pilotless target aircraft and related equipment, such as catapults and other ground support gear.

The Radioplane Company undertook the design, development and construction of the first radio-controlled aircraft target twenty years ago. Since then the company has expanded to become a leader in the field of pilotless aircraft. Over 40,000 Radioplane target drones have been delivered to the U.S. military services.

Beginning in 1935, a series of experimental drones was developed and the first production model (OQ-2A) was delivered in that year. The OQ-2A had a 6½ h.p. engine and cruised at 88 m.p.h. (141 km.h.). The current Radioplane target drone, the OQ-19, has a 72 h.p. engine, a cruising speed of 227 m.p.h. (363 km.h.) and is capable of climbing 2,400 ft./min. (730 m./min.) to a service ceiling of 20,000 ft. (6,100 m.).



The Radioplane YQ-1B Target Drone (Continental J69 turbojet engine).

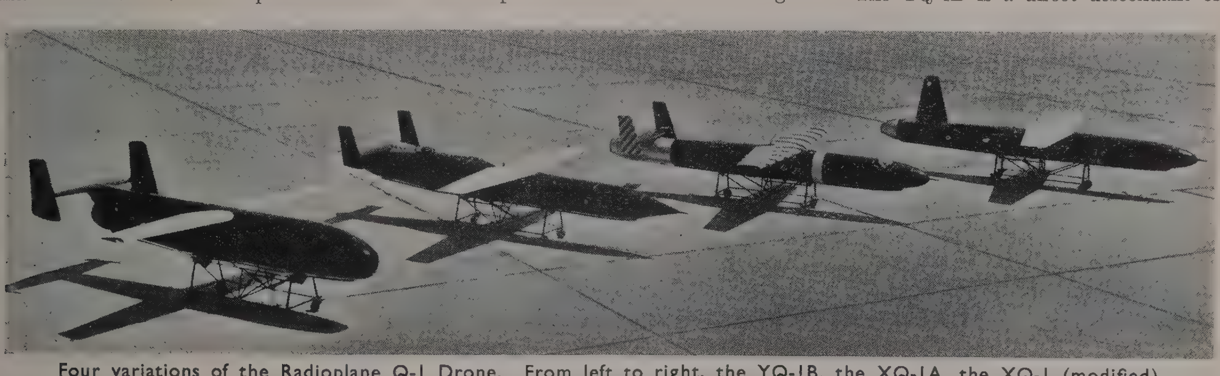
The Radioplane Company's Plastics laboratory is engaged in fulfilling an Air Materiel Command contract for the development of a plastic drone aircraft. One of the objectives of the programme is to explore the use of non strategic Fiberglas laminates in pilotless aircraft construction.

In addition to target drone work, Radioplane is participating in two research and development programmes for the U.S.A.F. These involve weapon systems of a highly-classified nature.

Since 1943 Radioplane has been engaged in research and development on parachute deceleration and recovery problems, and in the design, development and manufacture of missile recovery systems.

THE RADIOPLANE YQ-1B DRONE.

The YQ-1B is a direct descendant of



Four variations of the Radioplane Q-1 Drone. From left to right, the YQ-1B, the XQ-1A, the XQ-1 (modified) and the XQ-1.

the XQ-1 (pulsejet-powered) and XQ-1A (turbojet-powered) experimental drones. The XQ-1 test programme was initiated early in 1950 and the first flight of the YQ-1B was made late in 1953. The various configurations of the Q-1 drone had, at the time of writing, made over 60 free flights.

The YQ-1B airframe consists of an aluminium semi-monocoque fuselage with a straight all-metal wing and H-type tail-unit. It is powered by a Continental J69-T-19 (Marboré) turbojet engine (1,000 lb.=454 kg. s.t.).

Equipment is installed for out-of-sight controlled flight at distances in excess of 30 miles (48 km.) from the control station. Space and weight allowances have also been made to accommodate equipment required for special missions.

The YQ-1B is adaptable to air launching or to JATO-boosted or catapult ground launching.

DIMENSIONS.—
Span 14 ft. 3 in. (4.34 m.).
Length 17 ft. 3 in. (5.26 m.).
Height 4 ft. 4 in. (1.31 m.).

WEIGHT.—
Gross weight 2,000 lb. (908 kg.),

PERFORMANCE.
Speed at S.L. 575 m.p.h. (920 km.h.).
Service ceiling 45,000 ft. (13,725 m.).
Range 460 miles (736 km.).
Endurance 1 hour plus.


The Radioplane OQ-19D Target Drone on its A-7 catapult launcher.

THE RADIOPLANE OQ-19.

U.S. Air Force and Army designation: OQ-19D.
U.S. Navy designation: KD2R-3.

This aerial target is currently in use by the U.S. Air Force, Army Field Forces and the U.S. Navy as a training device for anti-aircraft gunnery. It is powered by a McCulloch O-100-1 four-cylinder two-stroke air-cooled engine rated at 72 h.p. at 4,150 r.p.m.

The OQ-19 is launched from a Radioplane A-7 catapult, is remotely controlled by radio and, after the completion of its mission, is recovered by the use of a radio-released 36 ft. (10.9 m.) parachute. In the event of serious damage by gunfire or loss of radio control, the parachute is deployed automatically. The target is of aluminium-alloy construction and is easily repaired if damaged by gunfire.

DIMENSIONS.—
Span 11 ft. 6 in. (3.50 m.).
Length 12 ft. 3 in. (3.74 m.).

WEIGHT.—
Ready for flight 317 lb. (144 kg.).

PERFORMANCE.—
Max. speed 238 m.p.h. (380 km.h.).
Rate of climb 3,000 ft./min. (915 m./min.).
Service ceiling 25,000 ft. (7,525 m.).
Endurance 1 hour.

RAWDON

RAWDON BROTHERS AIRCRAFT, INC.

HEAD OFFICE AND WORKS: P.O. Box 1119, WICHITA 1, KANSAS.

Manager: Gene Rawdon.

Rawdon Bros. Aircraft, Inc. has designed and built the T-1 two-seat monoplane, which is suitable for training, touring, crop-spraying, etc. It also manufactures aircraft spraying and dusting equipment, accessories, etc. and operates overhaul and maintenance shops.


The Rawdon T-1 (135 h.p. Lycoming O-290 engine).

THE RAWDON T-1.

TYPE.—Two-seat Training monoplane.

WINGS.—Low-wing semi-cantilever monoplane. Modified Göttingen 398 wing section. Chord 5 ft. 2 in. (1.57 m.). Dihedral 4° 30′. All-metal structure. Single steel-tube struts in plane of the main spar brace landing-gear attachment points to steel-tube pylon, between two seats. Steel-tube-framed ailerons and flaps are fabric covered. Gross wing area 166 sq. ft. (15.5 m.^{2}).

FUSELAGE.—Welded steel-tube structure covered with fabric over wooden formers.

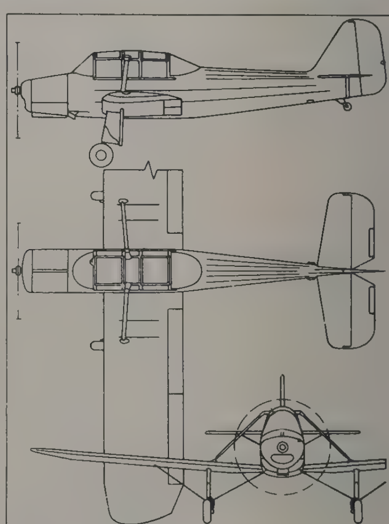
TAIL UNIT.—Braced monoplane type. Welded steel-tube frames covered with fabric. Statically-balanced rudder and elevators. Plywood-covered trim-tabs in both elevators. Span of tail 10 ft. 2 in. (3.09 m.).

LANDING GEAR.—Fixed tail-wheel type. Consists of two vertical welded steel-tube frames braced to wing spar on both sides by sloping struts. Rawdon oleo-spring shock-absorbers hinged at their lower extremities by torque links. Goodyear wheels and hydraulic disc brakes. Full swivelling and steerable tail-wheel on Maule oleo-spring strut. Track 9 ft. 11 in. (3 m.).

POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine. Sensenich fixed-pitch metal airscrew. Hartzell constant-speed airscrew optional. Two Goodyear Pliocel flexible fuel tanks in wing roots. Normal fuel capacity 38 U.S. gallons (144 litres), optional 44 U.S. gallons (166 litres).

ACCOMMODATION.—Tandem seats with dual controls under transparent canopy. Upper panels over seats hinge to right side for access and exit. Vertically sliding lower side panels. Baggage compartment aft of rear seat.


The Rawdon T-1S (135 h.p. Lycoming O-290 engine).


The Rawdon T-1.

DIMENSIONS.—
Span 33 ft. 4 in. (10.16 m.).
Length 24 ft. 2 in. (7.52 m.).
Height 7 ft. 3 in. (2.21 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,300 lb. (590 kg.).
Weight loaded 1,900 lb. (863 kg.).
Wing loaded 11.4 lb./sq. ft. (55.6 kg./m.²).
Power loading 12.7 lb./h.p. (5.76 kg./h.p.).
PERFORMANCE (150 h.p. Lycoming O-320 engine and fixed-pitch airscrew).—
Max. speed 138 m.p.h. (221 km.h.).
Cruising speed (65% power) 120 m.p.h. (192 km.h.).

THE RAWDON T-1S.

This is the crop-spraying version of the T-1, with which it is identical except for the installation of a spray tank and equipment. The spray manifolds are entirely within the wings, only the nozzles projecting below the lower surface. The tank holds up to 800 lb. of spray material. All spray equipment, except the manifolds, is quickly removable.

Landing speed (with flaps) 50 m.p.h. (80 km.h.).
Initial rate of climb 900 ft./min. (275 m./min.).
Service ceiling 18,000 ft. (5,490 m.).
Cruising range 500 miles (800 km.).
Take-off to clear 50 ft. (15.25 m.) with 12° flap 600 ft. (183 m.).
Landing distance from 50 ft. (15.25 m.) with 30° flap 600 ft. (183 m.).

REPUBLIC

THE REPUBLIC AVIATION CORPORATION.

HEAD OFFICE AND WORKS: FARMINGDALE, LONG ISLAND, N.Y.

President: Mundy I. Peale.

Vice-President in charge of Engineering: Alexander Kartveli.

Vice-President in charge of Industrial Relations: John J. Ryan.

Vice-President in charge of Sales: L. L. Brabham.

Vice-Presidents: Martin F. Scanlon and Tom Murphy.

Secretary: John A. Thompson.

Treasurer: Tom Davis.

Production facilities of the Republic Aviation Corporation are devoted entirely to the production of military aircraft.

Production of the F-84 Thunderjet came to an end on July 27, 1953, with the delivery of the 4,457th and last to the U.S.A.F. In addition to its widespread service with the U.S.A.F., the Thunderjet has been supplied under the Mutual Defence Assistance Plan to France, Belgium, the Netherlands, Norway, Italy, Greece, Denmark, Portugal, Turkey, Yugoslavia and Formosa.

The new swept-wing F-84F Thunderstreak and RF-84F Thunderflash are now in large-scale production. In 1954 twelve U.S.A.F. wings were equipped with the F-84F and one unit with the RF-84F. Deliveries were also begun to Europe, where F-84F's are being supplied to the air forces of nine N.A.T.O. powers.

Republic has engineering projects in various stages of design and development for other types of advanced aircraft and equipment for military use, details of which cannot be revealed.

REPUBLIC F-105.

Republic has been awarded a U.S.A.F. contract for the development of a fighter-bomber to be powered by the Allison J71-A-7 turbojet engine, which has been given the designation F-105. A reconnaissance version, the RF-105, is also being built. No further details were available for publication at the time of writing.

THE REPUBLIC F-103.

A contract is also held for the production of a research supersonic fighter to be powered by an Allison J71 turbojet engine, plus ramjet power. It carries the designation F-103. No further details are available.

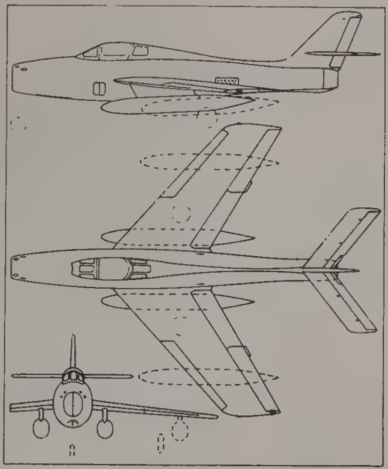
THE REPUBLIC THUNDERSTREAK.

U.S.A.F. designation: F-84F.

This aircraft was originally intended to be a swept-wing version of the F-84E Thunderjet to be powered with an Allison J35-A-29 engine (5,800 lb. = 2,630 kg. s.t.). It was also proposed to redesignate this production aircraft the YF-96A. A prototype XF-84F using an F-84E fuselage, but fitted with an Allison J35-A-25 engine (5,200 lb. = 2,360 kg. s.t.) was engineered, built and flown in six months, its first flight being made on June 3, 1950.

The impending availability of the high-powered Sapphire engine (7,200 lb. = 3,270 kg. s.t.), for which Curtiss-Wright had acquired a manufacturing licence, resulted in the decision to re-engine the F-84F and a prototype fitted with an imported British-built Sapphire flew for the first time on February 14, 1951. As the result of successful trials this version, to be powered with the Wright J65 Sapphire engine, was selected for large-scale production.

The new power-plant, with its larger dimensions and greater power, called for a considerable number of design and production changes with the result that, compared with the F-84E, the swept-wing F-84F is almost entirely a new aeroplane.



The Republic F-84F Thunderstreak.

Both wings and tail of the F-84F have a sweepback of 40° at 25 per cent. of the chord. The new wings incorporate a high proportion of press forgings in place of built-up components in their structure, and they are now fitted with leading-edge auto slats.

Other new features of the F-84F are an upward-hinged canopy; perforated air-brakes hinged to the fuselage sides aft of the wing trailing-edge; in-flight refuelling equipment with the inlet nozzle in the upper surface of the port wing; and an irreversible power-boosted control system. In the first production aircraft the all swept tail had both adjustable tail surfaces and elevators, but later versions incorporate a one-piece "flying" tail.

The F-84F has the standard F-84 armament of six .50-in. machine-guns, four in the fuselage and one in each wing, but it carries heavier loads of external stores and fuel than its predecessors. Like the F-84G, it is equipped for in-flight refuelling. Stores may include twenty-four 5-in. rockets, or four 1,000-lb. bombs, or two 230 U.S. gallon (870 litre) drop tanks plus various combinations of offensive stores, including atomic weapons. For long-range escort fighter duties two 450 U.S. gallon (1,700 litre) external tanks may be carried. Like its predecessor, the F-84F is equipped for in-flight refuelling.

The first production F-84F was delivered to the U.S.A.F. on December 3, 1952.

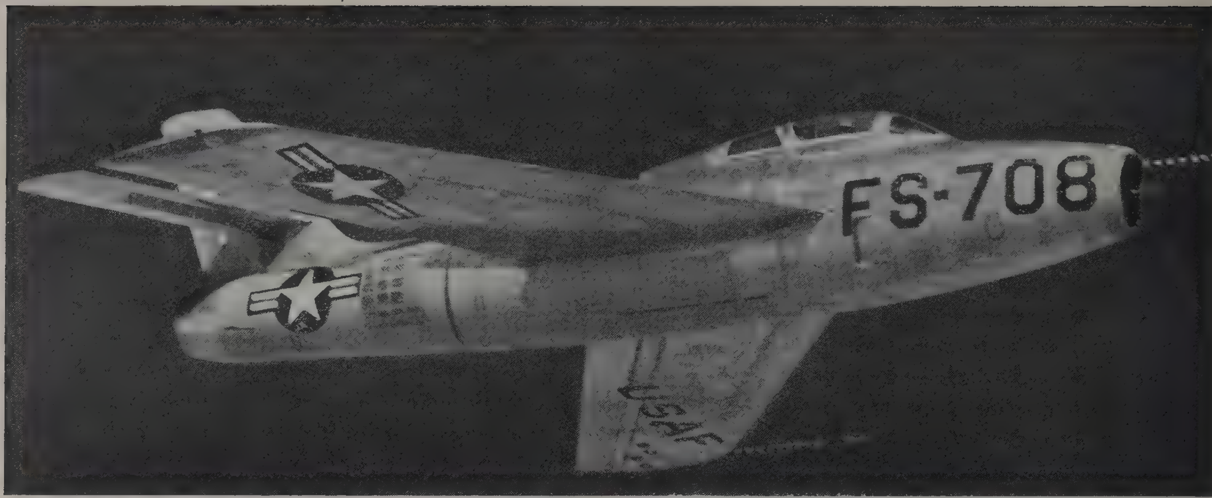
DIMENSIONS.—
Span 33 ft. 6 in. (10.21 m.).
Length 43 ft. 4 in. (13.21 m.).
Height 14 ft. 4 in. (4.37 m.).

WEIGHTS.—
Weight loaded (approx.) 25,000 lb. (11,350 kg.).

PERFORMANCE.—
Max. speed over 650 m.p.h. (1,040 km.h.).
Combat radius over 1,000 miles (1,600 km.).
Service ceiling over 45,000 ft. (13,725 m.).

Two developed prototypes of the F-84F carrying the designation YF-84J have been built, the first of which flew for the first time on May 12, 1954. This version, powered by a General Electric J73 turbojet engine, is capable of carrying an A-weapon. The YF-84J has a redesigned air-intake duct and fuselage, increased dive-brake area and many internal changes.

The Republic F-84F Thunderstreak (Allison J35 turbojet engine). (*Gordon Williams*).



The Republic YF-84J Thunderstreak (General Electric J73 turbojet engine).

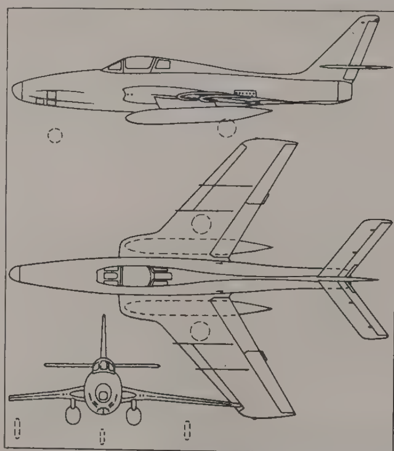
THE REPUBLIC THUNDERFLASH.

U.S.A.F. designation: RF-84F.

The Thunderflash is the tactical reconnaissance version of the F-84F. Unlike the Thunderstreak which has a nose air-intake, the RF-84F has wing-root intakes so as to enable it to carry several cameras in varying combinations in the fuselage nose. An armament of four .50-in. machine-guns, two in each wing, is provided for self protection.

Like the F-84F, the Thunderflash is powered by a Wright J65-W-3 engine (7,200 lb.=3,270 kg. s.t.).

Modifications have been ordered on an undisclosed number of RF-84F's to enable them to be used in connection with the FICON very long range reconnaissance project. This name refers to the GRB-36/RF-84F "Composite" which combines the global range of the 10-engined Convair B-36 with the high speed and manoeuvrability of the RF-84F, the B-36 being provided with mechanism to enable the RF-84F to be launched and retrieved in mid-air. By these means the RF-84F can be carried 4,000 miles under the bomb-bay of the B-36, be released 1,000 miles from its target, accomplish its mission, and then rejoin its carrier for the long journey home.



The Republic RF-84F Thunderflash.

DIMENSIONS.—
Span 33 ft. 6 in. (10.21 m.).
Length 47 ft. 6 in. (14.48 m.).
Height 15 ft. (4.57 m.).

WEIGHTS AND PERFORMANCE.—
Restricted.

One Thunderflash airframe has been modified to permit the installation of an Allison T54 turboprop engine, driving an Aeroproducts six-blade co-axial contra-rotating high-speed small-diameter airscrew in the nose of the fuselage. This aircraft, which carries the designation XF-84H, is taking part in a U.S.A.F. supersonic airscrew flight test programme.

Except for the engine installation the

The Republic RF-84F Thunderflash Photographic Reconnaissance Monoplane (Wright J65 turbojet engine).

The Republic RF-84F Thunderflash Photographic Reconnaissance Monoplane (Wright J65 turbojet engine).

only major external change is in the re-positioning of the swept horizontal tail on top of the swept fin.

THE REPUBLIC THUNDERJET.

U.S. Air Force designation: F-84.

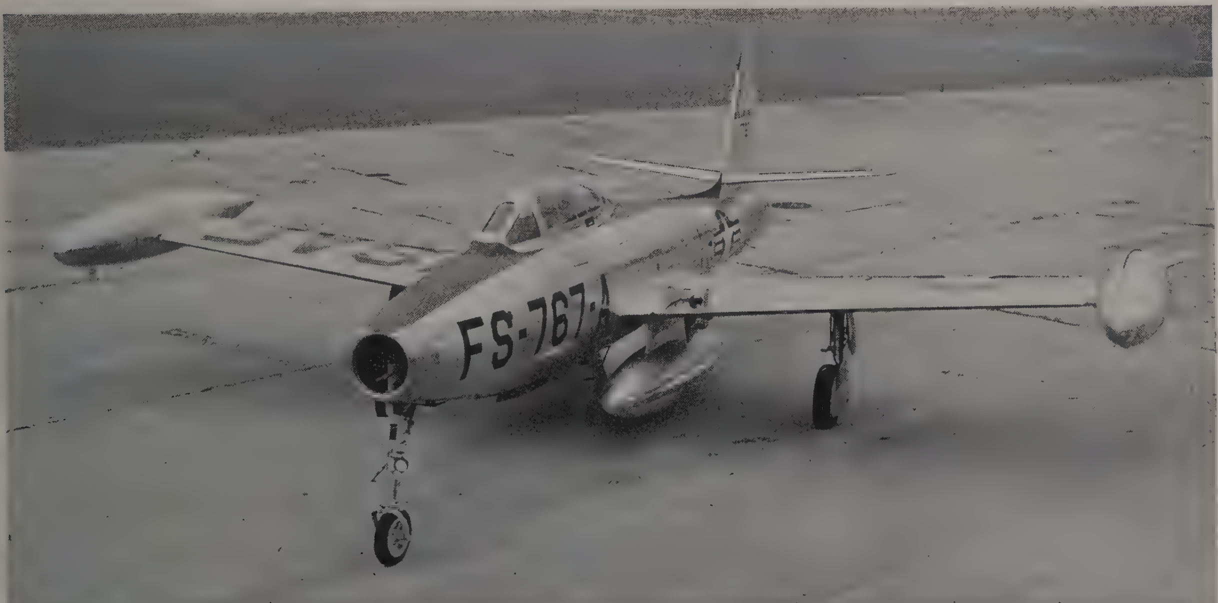
The Thunderjet was developed under the joint supervision of the Republic company and the U.S.A.A.F. Air Material command. The first prototype XF-84 flew on February 28, 1946.

Current versions still in service are the F-84E and F-84G, descriptions of which appear below.

F-84E. Fitted with Allison J35-A-17 engine rated at 5,000 lb. (2,270 kg.) s.t. Longer fuselage to give more room in cockpit, wing-tip tanks fitted with fins to permit full manoeuvrability with tanks fitted, structural modifications to increase permissible G loads, and other improvements to simplify maintenance. Addition of two 230 U.S. gallon drop tanks on bomb shackles beneath wings inboard of landing-gear increases combat radius to over 1,000 miles (1,600 km.). In addition to fixed armament, F-84E can carry 32 5-in. rockets; or two 11.5-in. and 16 5-in. rockets; or two 1,000-lb. bombs and 18 5-in. rockets or other various combinations of expendable stores. Provision for four 1,000-lb. Jato units for accelerated take-off. First F-84 version to be supplied under M.D.A.P. to nations participating in the North Atlantic Treaty Organization.

F-84G. Progressive development of F-84E. Fitted with in-flight refuelling equipment with wing receptacle in port wing for use with the Boeing "flying-boom" system. Automatic pilot fitted. Allison J35-A-29 engine rated at 5,600 lb.

A piloted Republic F-84 Thunderjet being launched experimentally from a Martin Zero-length launcher, similar to that used for the TM-61 tactical missile.



The Republic F-84G Thunderjet, the first operational fighter aircraft to be equipped for air-to-air refuelling.

=2,540 kg. s.t., or 10 per cent. more than F-84E power-plant. Replaced F-84E in production and was delivered to U.S.A.F. and nations participating in the N.A.T.O. The F-84G was the first U.S.A.F. fighter-bomber announced as being equipped to carry the atomic bomb. Withdrawn from production in July, 1953. Using in-flight refuelling, a group of F-84G's taking part in "Operation Longstop" in August, 1943, flew 4,485 miles from Georgia to Lakenheath, England, the longest non-stop distance ever covered by jet fighters.

The description below refers specifically to the F-84G.

TYPE.—Single-seat Jet Fighter.

WINGS.—Low mid-wing cantilever monoplane. Republic high-speed laminar-flow wing-section. Dihedral 5°. All-metal structure with flush-riveted stressed-skin. Flaps between ailerons and fuselage. Root chord 9 ft. 2¼ in. (2.8 m.), tip chord 5 ft. 3 in. (1.6 m.).

FUSELAGE.—Circular section structure. All-metal construction with flush-riveted stressed skin.

TAIL UNIT.—Cantilever monoplane type. Tailplane dihedral 5°. Trim-tabs in elevators and rudder. Tailplane span 14 ft. 11½ in. (4.5 m.).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Track 16 ft. 6 in. (5.03 m.).

POWER PLANT.—One Allison J35-A-17 axial-flow turbojet engine in fuselage aft of wings with nose air inlet and tail exhaust exit. Rear section of fuselage removable for access to engine compartment and to permit complete replacement of engine in 50 minutes. Main fuel tankage in wings. External tanks may be carried on bomb-shackles at wing roots and at wing tips. Provision for in-flight refuelling.

ACCOMMODATION.—Pilot's pressurised cockpit ahead of wing leading-edge. Electrically-operated jettisonable bubble canopy. Pilot's ejector seat.

ARMAMENT.—Six .50 in. (12.7 mm.) machine-guns, four in nose of fuselage and two in wings, one on each side of fuselage. Provisions for carrying rocket or bomb loads or various combinations of each up to a maximum weight of 4,500 lb. (2,045 kg.).

DIMENSIONS.—
Span 36 ft. 4¾ in. (11.10 m.).
Length 38 ft. 1¼ in. (11.62 m.).
Height 12 ft. 7 in. (3.84 m.).

WEIGHTS.—
Weight empty over 11,000 lb. (4,995 kg.).
Max. gross weight over 18,000 lb. (8,172 kg.).

PERFORMANCE.—
Max. speed over 600 m.p.h. (960 km.h.) at sea level.
Service ceiling, over 45,000 ft. (13,725 m.).
Combat radius 850 miles (1,360 km.).
Combat radius (with four external fuel tanks) 1,000 miles (1,600 km.).

RYAN

THE RYAN AERONAUTICAL COMPANY.

HEAD OFFICE AND WORKS: LINDBERGH FIELD, SAN DIEGO 12, CALIFORNIA.

President: T. Claude Ryan.

Executive Vice-President: G. C. Woodard.

Vice-President—Manufacturing: L. M. Limbach.

Vice-President and Chief Engineer: Frank W. Fink.

Director of Engineering: Bruce Smith.

Secretary and Treasurer: C. A. Stillwagen.

Sales and Export Manager: Sam C. Breder.

The Ryan Aeronautical Company is a successor to the old Ryan Company which produced the aeroplane in which Mr. Charles Lindbergh made the first non-stop flight from New York to Paris in 1927.

In the Summer of 1947, the Ryan company acquired the design and manufacturing rights of the Navion four-seat all-metal light cabin monoplane from North American Aviation, Inc. Over 1,000 civil Navions were built during the years 1948-50, but production was suspended in 1951 to enable the company to devote its entire activities to the Defense Programme.

The current activities of the Ryan Aeronautical Company are diversified and fall into three main groups:— (*a*) research and development in and the manufacture of aircraft and aeronautical products of the company's own design; (*b*) production of airframe components for other manufacturers; and (*c*) the production of high-temperature parts for aircraft engines.

Important aeronautical research programmes, including production of the Ryan Firebee pilotless jet-powered target aircraft, are being conducted for the Air Force, Army and Navy. Prime contracts are held for the development of guidance systems for missiles and other electronic devices of Ryan design.

Among airframe components of Ryan design being manufactured in volume are external fuel tanks, including the largest known to be in production anywhere.

For aircraft engines Ryan builds heat and corrosion-resistant stainless-steel components, and applies ceramic coatings for jet engines, piston engines and rocket motors. Products include such items as exhaust cones, tail pipes, combustion chambers, afterburners and exhaust nozzles for jet engines, exhaust systems for aircraft piston engines, and complete rocket motors for guided missiles.

THE RYAN TYPE 69.

U.S.A.F. designation: XF-109.

Ryan has been awarded a contract by the U.S.A.F. for the development of a jet-powered vertical take-off aircraft, which carries the designation XF-109. This VTO aircraft will be powered by a Rolls-Royce Avon turbojet engine. No other details have been released.

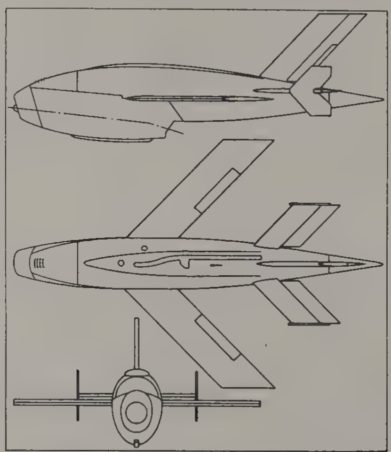
THE RYAN FIREBEE.

U.S. Air Force designation: Q-2.
U.S. Army designation: XM21.
U.S. Navy designation: KDA-1.

The Firebee is a pilotless remotely-controlled high-speed turbojet-powered target drone which has been developed under a joint Air Force/Army/Navy project, with the U.S.A.F. Air Research and Development Command having technical cognizance of its development.

Early in 1953 Army Ordnance placed the first military contract for the Ryan Firebee. These targets, officially designated XM21, are being put into operation at the Army Ordnance Proving Ground at White Sands, N.M., and at Fort Bliss, Texas, where they will be used in training Army troops in the operation of the "Skysweeper" gun and for use as a target for the Nike "ground-to-air" guided missile.

In the Spring of 1944 it was announced that the U.S. Navy had placed an order for an undisclosed quantity of the Firebee to carry the naval designation KDA-1.



The Ryan Firebee.

This version will be used for fleet anti-aircraft, aerial gunnery and guided missile training.

The Firebee is an all-metal mid-wing monoplane with swept-back wings and tail surfaces. It is powered by a Fairchild J44-R-20 or a Continental J69-T-19 (Turbomeca Marboré II licence) turbojet engine, both rated at 1,000 lb. (454 kg.) s.t. which is mounted in a nacelle which forms the lower part of the forward fuselage and exhausts below the rear fuselage.

To achieve the most economical use of the drone, a two-stage parachute system has been developed to decelerate the drone from its near-sonic operating speed and to lower it safely to the ground without damage to the aircraft structure or its delicate electronic controls.

The recovery system is also capable of lowering the drone to the ground automatically in the event of a target hit, loss of radio wave carrier from the remote-control station, engine failure, or upon command by the remote control operator. To prevent damage by dragging, the recovery system incorporates a disconnect system which releases the parachute from the drone upon contact with the ground.

The Firebee is composed of five major assemblies—fuselage, engine nacelle, wing, tail-unit and parachute container. Construction is of aluminium, magnesium and stainless-steel. The wing and tail-unit are attached to the fuselage by four self-aligning bolts. The engine nacelle is hinged to give ready access to the interior of the compartment.

Remote control methods for the Firebee include a choice of radar, radio, active seeker and automatic navigator, all developed and designed by Ryan. Reflectors which are sensitive to radar have been incorporated to give gun crews an image on their radar scopes similar to that of a full-sized aircraft.

Glide flight tests of the Firebee without power were begun in March, 1951, and the first powered flights were made that

The Ryan Firebee Target Drone after landing by parachute.

Summer at the U.S.A.F. Holloman Air Development Center, Alamogordo, New Mexico. In the subsequent test programme the Firebee was launched from under the wings and from the bomb-bay of a Douglas B-26 carrier.

The Army XM21 is ground-launched from a zero-length launcher with the aid of a booster rocket, which is jettisoned after the target's jet engine has taken over.

The U.S. Navy KDA-1, which will be either ramp or air launched, is fitted with flotation equipment for recovery at sea.

The following specification is based on the U.S.A.F. Q-2A version but applies in general to all three models.

TYPE.—Remote-controlled Jet Target Drone.

WINGS.—Mid-wing swept type. Aerofoil section NACA 63, A014.6. Aspect ratio 4.62. All-metal one-piece structure attached to fuselage by four bolts. Area of ailerons 2.08 sq. ft. (0.193 m.²) aft of hinge-line. Gross wing area 27.0 sq. ft. (2.508 m.²).

FUSELAGE.—All-metal structure in one complete assembly.

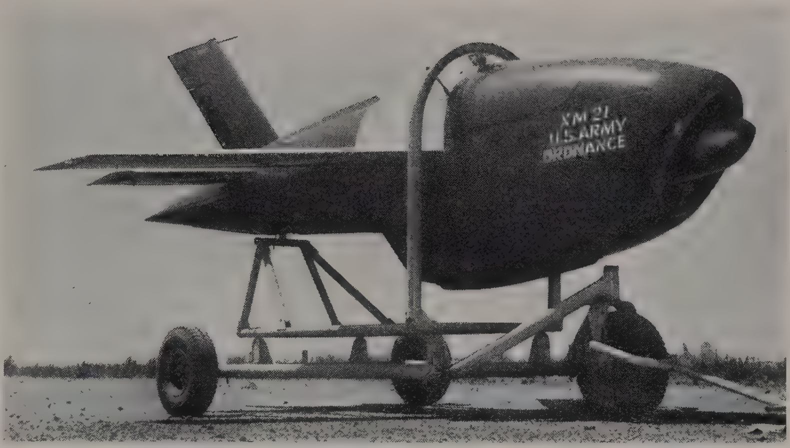
TAIL UNIT.—Single assembly attached to fuselage by four bolts. All surfaces swept. Areas: fin 6.07 sq. ft. (0.564 m.²), vertical end plates 5.21 sq. ft. (0.484 m.²), tailplane 8.94 sq. ft. (0.830 m.²) elevators (aft of hinge-line) 3.36 sq. ft. (0.312 m.²).

POWER PLANT.—One Fairchild J44-R-20 or Continental (Turbomeca licence) J69-T-19 turbojet engine (1,000 lb.=454 kg. s.t. each). Fuel capacity 100 U.S. gallons (378 litres). Oil capacity 1 U.S. gallon (3.78 litres).

DIMENSIONS.—
Span 11 ft. 2 in. (3.40 m.).
Length 17 ft. 3 in. (5.26 m.).
Height 5 ft. 10 in. (1.79 m.).

WEIGHTS.—
Weight empty 1,181.4 lb. (536 kg.).
Weight loaded 1,848.6 lb. (839 kg.).

PERFORMANCE.—
Max. speed at S/L, 610 m.p.h. (976 km.h.).
Max. speed at 40,000 ft. (12,200 m.) 605 m.p.h. (968 km.h.).
Rate of climb at S/L. 8,500 ft./min. (2,590 m./min.).
Time to climb from launch altitude to 40,000 ft. (12,200 m.) 8 min.
Stalling speed 162 m.p.h. (259 km.h.).
Service ceiling 42,500 ft. (12,960 m.).
Endurance at 40,000 ft. (12,200 m.) at 575 m.p.h. (920 km.h.) 1 hr. 20 min.



The Ryan Firebee Target Drone (Fairchild J44 turbojet engine).

SCHWEIZER

SCHWEIZER AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: COUNTY AIRPORT, ELMIRA, N.Y.

President and Chief Engineer: Ernest Schweizer.

Vice-President and General Manager: Paul A. Schweizer.

Vice-President in charge of Manufacturing: William Schweizer.

Director, Personnel and Public Relations: Eugene S. Bardwell.

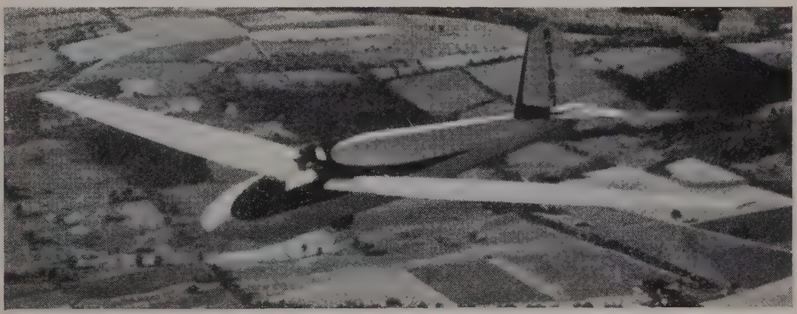
Treasurer: Nicolas Haich.

Secretary: Robert P. McDowell.

The Schweizer Aircraft Corpn. specialises in the design and construction of gliders and sailplanes. It also manufactures parts and assemblies for other aircraft companies under sub-contract. The company furthermore maintains a complete aircraft and glider overhaul and repair service.

Schweizer is currently engaged in producing three gliders, the SGU 2-22 two-seat training glider, the SGS 1-23D single-seat high-performance sailplane and the SGS 1-26 single-seat high-performance sailplane which is available both complete and in kit form for the home-builder.

At the time of writing some forty kits of the SGS 1-26 all-metal sailplane were on order.


The Schweizer SGS 1-23D Single-seat Sailplane.

THE SCHWEIZER SGS 1-23D SAILPLANE.

The SGS 1-23D is the latest development of the 1-23 from which it differs mainly by having wings of higher aspect ratio for increased performance.

The earlier SGS 1-23 was first flown at the 1948 National Soaring Contest at Elmira, N.Y. On December 30, 1950, William Ivans in a 1-23 set a new World's Height Record when he soared to an absolute altitude of 42,100 ft. (12,832 m.) above sea level at Bishop, California. He gained 30,100 ft. (9,180 m.) above his release from aeroplane tow. This flight was made by using the famous "standing wave" caused by winds blowing in from the Pacific over the top of the Sierra Nevada Mountains, dipping into the Owens Valley and sweeping up again over the White Mountains.

Production of the 1-23D was started in July, 1953. The description below refers to this model.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Mid-wing cantilever monoplane. Aspect ratio 15.58. All-metal structure. Aileron area (total) 19.40 sq. ft. (1.80 m.²). Spoiler area (total) 5.00 sq. ft. (0.464 m.²). Gross wing area 160 sq. ft. (14.87 m.²).

FUSELAGE.—Semi-monocoque structure of aluminium-alloy.

TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering. Tailplane span 7 ft. (2.13 m.). Horizontal tail surface area 15.13 sq. ft. (1.405 m.²) Vertical tail surface area 10.61 sq. ft. (0.98 m.²).

LANDING GEAR.—Single unsprung wheel with Schweizer brake on fuselage centre-line, with single skid on solid rubber blocks ahead of wheel. Rubber-mounted tail-skid.

ACCOMMODATION.—Pilot's cockpit with moulded Plexiglas canopy. Fully equipped instrument panel. Room behind pilot for radio, baragraph and oxygen equipment.

DIMENSIONS.—
Span 50 ft. (15.25 m.).
Length 20 ft. 9 in. (6.33 m.).
Height 6 ft. 10 in. (2.08 m.).

WEIGHTS AND LOADINGS.—
Weight empty 400 lb. (181.4 kg.).
Pilot 190 lb. (86 kg.).
Extra equipment 160 lb. (72.6 kg.).
Max. permissible loaded weight 750 lb. (340 kg.).
Wing loading 4.69 lb./sq. ft. (22.66 kg./m.²).

PERFORMANCE.—
Designed max. speed 132 m.p.h. (211 km.h.).
Cruising speed 85 m.p.h. (136 km.h.).
Min. sinking speed 2.0 ft./sec. (0.6 m./sec.).
Max. glide ratio 30 : 1.
Glide or Dive Placard speed 119 m.p.h. (190 km.h.).
Aeroplane towing speed 110 m.p.h. (176 km.h.).
Auto towing speed 68 m.p.h. (109 km.h.).

The Schweizer SGS 1-26 Sailplane which is marketed in kit form.

THE SCHWEIZER SGS 1-26 SAILPLANE.

Externally similar to the earlier SGS 1-23D, the SGS 1-26 first flew in January, 1954, and production was under way in November, 1954. Whereas the earlier SGS 1-23D was entirely of metal construction, the SGS 1-26, which is available in kit form, has fabric-covered outer wing panels, control surfaces, fuselage and

tail-unit. Further to assist the amateur constructor, all the complicated alignments, welding and assemblies requiring specialised tooling are undertaken by the manufacturer, including a pre-formed aluminium nose-cap and Plexiglas canopy. The design has been granted an Approved Certificate (No. TC1G10). From 300 to 600-man-hours are required for assembly depending on the experience and skill of the builder.

Type.—Single-seat High-performance Sailplane.

Wings.—Mid-wing cantilever monoplane. Aspect ratio 10. Dihedral $3\frac{1}{2}$°. All-metal structure of aluminium alloy. Strengthened metal-covered pre-formed leading-edge. Fabric-covered rear sections of outer wing panels. Spoiler area (two) total 2.78 sq. ft. (0.26 m.²). Wing area 160 sq. ft. (14.87 m.²).

Fuselage.—Welded chrome-molybdenum steel tube framework covered with fabric.

Tail Unit.—Cantilever monoplane type. Aluminium-alloy structure covered with fabric. Tailplane span 7 ft. 6 in. (2.29 m.).

Landing Gear.—Single unsprung wheel (4.00-4 with Schweizer brake) on the fuselage centre-line with single-skid on solid rubber blocks ahead of wheel. Rubber-mounted tail-skid.

Accommodation.—Single-seat beneath moulded Plexiglas canopy. Provision for radio behind pilot.

Dimensions.—
Span 40 ft. (12.19 m.).
Length 21 ft. 3 in. (6.48 m.).
Height 7 ft. $2\frac{1}{2}$ in. (2.21 m.).

Weights and Loadings.—
Weight empty 350 lb. (158.76 kg.).
Pilot 190 lb. (86 kg.).
Extra equipment 35 lb. (15.88 kg.).
Max. (gross) weight 575 lb. (260.6 kg.).
Wing loading (normal) 3.13 lb./sq. ft. (15.15 kg./m.²).
Wing loading (max.) 3.54 lb./sq. ft. (17.29 kg./m.²).

Performance.—
Min. sinking speed less than 2.5 ft./sec.
Max. glide ratio more than 23 : 1.

SIKORSKY

SIKORSKY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION.

Head Office and Works: South Avenue, Bridgeport, Conn.

General Manager: B. L. Whelan.
Assistant General Manager: R. A. Aspinwall.
Engineering Manager: Igor I. Sikorsky.
Chief Engineer: Michael E. Gluhareff.
Factory Superintendent: Alex Sperber.
Divisional Controller: Paul W. Holt.
Divisional Auditor: G. L. Wadman.

In addition to the more than 600,000 square feet of production space in operation at its main plant in Bridgeport, Sikorsky Aircraft is constructing a branch plant in Stratford. This plant will provide another 800,000 square feet of working space which will be devoted primarily to the production of the HR2S twin-engined assault helicopter. Production of the S-55 and other types will continue in the main plant.

The S-55 is being produced under licence in the United Kingdom, by Westland Aircraft, Limited, Yeovil, Somerset, and in France by the Société Nationale de Constructions Aéronautiques du Sud-Est.

THE SIKORSKY S-55.

U.S.A.F. and U.S. Army designation: H-19.
U.S. Navy and Coast Guard designation: HO4S.
U.S. Marine Corps designation: HRS.

The S-55 is a twelve-seat utility helicopter suitable for passenger, air mail or cargo transport and for air rescue and military service. The novelty of the design is the location of the power-unit in the nose of the fuselage and so mounted that the drive shaft slopes up to base of the rotor pylon, clear of the main cabin situated below the main lifting rotor. The prototype S-55 first flew on November 7, 1949.

Apart from being adopted by the U.S.A.F., U.S. Army Field Forces, U.S. Navy, U.S. Marine Corps and U.S. Coast Guard, the S-55 is also being built under licence in the United Kingdom by Westland Aircraft Ltd. and in France by the S.N.C.A.S.E.

The civil S-55 is fitted with the 550 h.p. Pratt & Whitney Wasp R-1340-S1H2 engine. The many U.S. naval and military versions, which do not all have the same power-plant, are enumerated below :—

H-19A. 550 h.p. Pratt & Whitney R-1340-57 engine. For U.S.A.F. Rotor diameter 49 ft. (14.94 m.). A.U.W. 6,800 lb. (3,087 kg.). Crew of two, plus eight troops or six stretchers.

H-19B. 700 h.p. Wright R-1300-3 engine. For U.S.A.F. Rotor diameter 53 ft. (16.16 m.). A.U.W. 7,300 lb. (3,314 kg.). Crew of two, plus ten troops or eight stretchers.

H-19C. Same as H-19A for U.S. Army Field Forces.

H-19D. Same as H-19B for U.S. Army Field Forces.

HO4S-1 and -2. 550 h.p. Pratt & Whitney R-1340 engine. Similar to H-19A. For U.S. Navy for anti-submarine duties.

HO4S-2G. For U.S. Coast Guard. HO4S-2 fitted for rescue duties.

HO4S-3. 700 h.p. Wright R-1300 engine. Similar to H-19B. For U.S. Navy for anti-submarine duties.

HRS-1 and -2. 550 h.p. Pratt & Whitney R-1340 engine. Similar to H-19A. For U.S. Marine Corps for assault transport duties. Crew of two and eight fully-armed troops.

HRS-3. 700 h.p. Wright R-1300 engine. Similar to H-19B. U.S. Marine Corps assault transport.

HRS-4. 1,025 h.p. Wright R-1820 engine. U.S. Marine Corps assault transport. Crew of two and ten fully-armed troops.

The description and specification which follow refer to the S-55 and may also apply generally to those military versions fitted with the 550 h.p. Pratt & Whitney R-1340 engine. The performance of later military models powered by the Wright R-1300 and R-1820 engines are appreciably higher but details are classified.

Type.—Twelve-seat Utility Helicopter.

Rotors.—Three-blade main rotor and two-blade anti-torque tail rotor. All-metal structures. Rotor mechanism operates as in S-52.

Fuselage.—Except for the chrome-molybdenum steel-tube rotor pylon, structure is of aluminium and magnesium semi-monocoque construction.

Landing Gear.—Quadricycle type. All-metal amphibious landing-gear is available.

Power Plant.—One Pratt & Whitney R-1340 S1H2 Wasp radial air-cooled engine rated at 550 h.p. at 8,000 ft. (2,440 m.) and with 600 h.p. available for take-off at 6,200 ft. (1,890 m.). Engine on angular mounting in nose of fuselage with sloping shaft drive to rotor gear box below head. Large clam-shell doors in nose of fuselage allow complete accessibility to engine from ground level. Internal fuel capacity 190 U.S. gallons (720 litres).

Accommodation.—Pilot's compartment above main cabin seats two side-by-side with dual controls. Cabin located below main lifting rotor may seat from eight to ten passengers, the ten passengers being seated three against front and rear walls and two on each side, all facing inwards. Up to eight stretchers may be carried six of which can be loaded by power-operated hoist while aircraft is hovering. Pilot's compartment may be entered from the outside or from the cabin so that co-pilot may act as attendant. Cabin dimensions: length 10 ft. (3.05 m.), width 5 ft. 6 in. (1.68 m.), depth 6 ft. (1.82 m.). Total capacity 340 cub. ft. (9.6 m.³).

Dimensions.—
Main rotor diameter 53 ft. (16.16 m.).

The Sikorsky S-55 Eight-passenger Commercial Helicopter (600 h.p. Pratt & Whitney R-1340 Wasp engine).

The Sikorsky HO4S-3 Naval General Utility Helicopter (700 h.p. Wright R-1300 engine). (*Harold Martin*).

Tail rotor diameter 8 ft. 8 in. (2.64 m.).
Fuselage length 42 ft. 2 in. (12.85 m.).
Height overall 13 ft. 4 in. (4.07 m.).

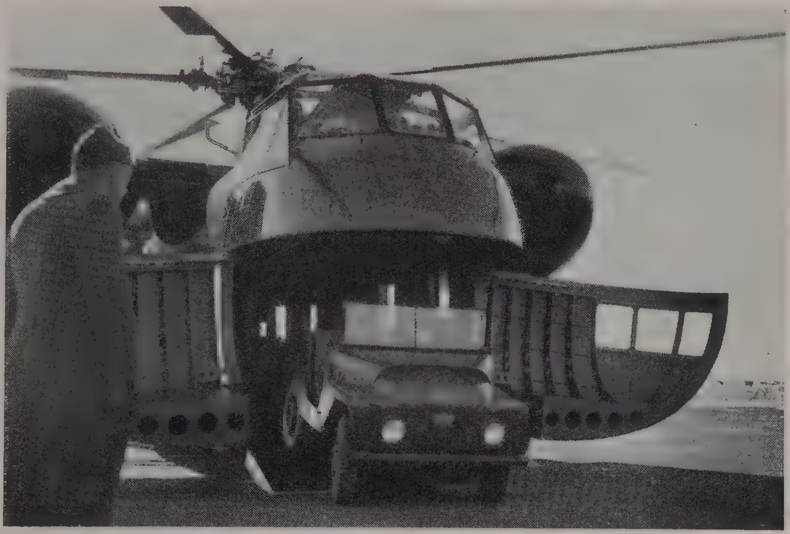
WEIGHTS.—
Weight empty 4,785 lb. (2,173 kg.).
Max. disposable load 2,050 lb. (932 kg.).
Max. weight loaded 6,835 lb. (3,102 kg.).

PERFORMANCE (at normal A.U.W. of 6,835 lb.=3,102 kg.—Pratt & Whitney R-1340 engine).—
Max. speed at S/L. 105 m.p.h. (169 km.h.).
Cruising speed (70% power) at 1,000 ft. (305 m.) 90 m.p.h. (145 km.h.).
Max. rate of climb at S/L. 855 ft./min. (261 m./min.).
Vertical rate of climb at S/L. 170 ft./min. (52 m./min.).
Hovering ceiling with ground effect 7,900 ft. (2,410 m.).
Hovering ceiling without ground effect 4,400 ft. (1,340 m.).
Service ceiling 12,900 ft. (3,940 m.).
Range (with reserve) 440 miles (707 km.).

THE SIKORSKY S-56.

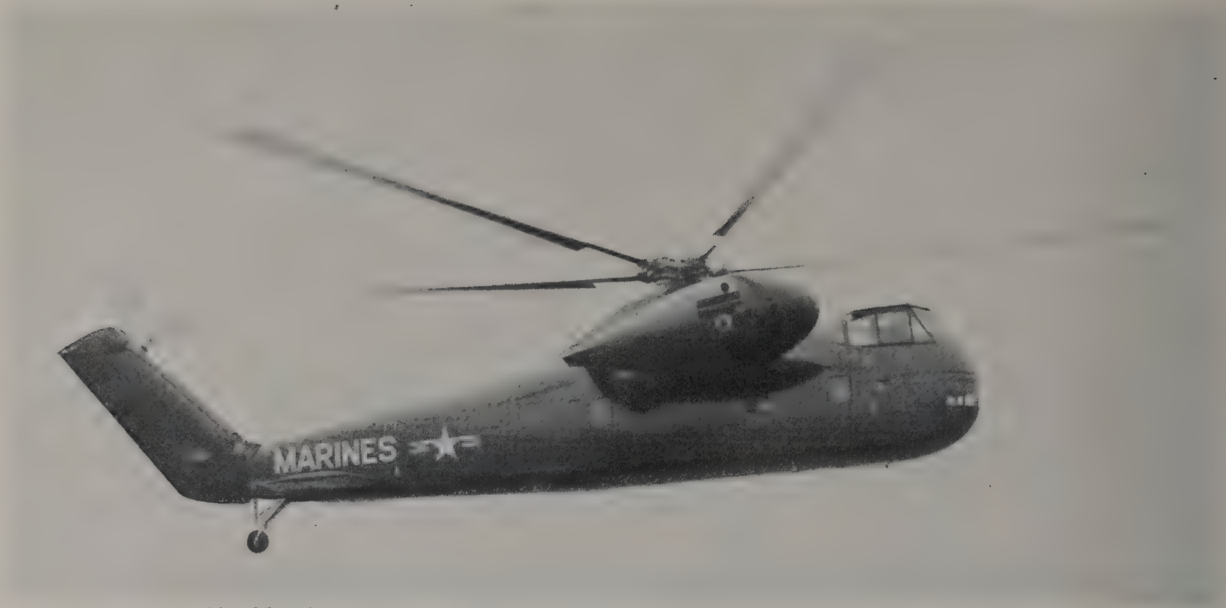
U.S. Marine Corps designation: HR2S-1.
U.S. Army designation: H-37.

The HR2S-1 is a twin-engined single-rotor transport helicopter which is comparable in size to the Douglas DC-3 transport. It was designed to meet the requirements of the U.S. Marine Corps



A Jeep driving out of the hold of the Sikorsky XHR2S-1 Helicopter.

The Sikorsky XHR2S-1 Transport Helicopter (two Pratt & Whitney R-2800 engines).



The Sikorsky XHR2S-1 Transport Helicopter (two Pratt & Whitney R-2800 engines).

as an Assault helicopter and will carry about twenty-six fully-equipped troops, equivalent to two combat assault squads. Hydraulically-operated nose doors will permit the loading of heavy equipment, which may comprise up to three Jeeps or the equivalent in weight and bulk.

The U.S. Army has shown interest in the future use of the HR2S and has contributed financially to its development.

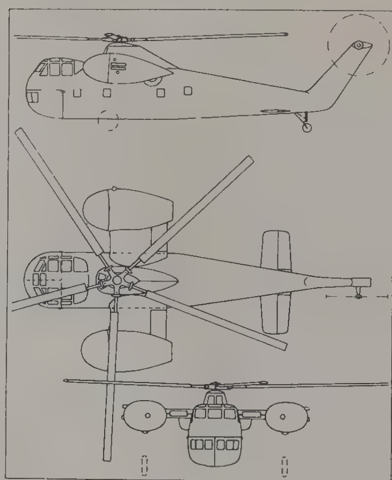
The HR2S-1 is powered by two Pratt & Whitney R-2800 engines which are mounted in outboard nacelles on short wing stubs. Power from both engines is transmitted to the five-blade main rotor and the small tail rotor, both of which fold for easy handling and stowage aboard aircraft-carriers.

This helicopter is believed to be the first ever built with a retractable landing-gear, a feature which contributes to its top speed of over 150 m.p.h. (240 km.h.).

For bad weather flying the HR2S is fitted with anti-icing equipment and an automatic pilot.

The prototype XHR2S-1 made it first flight on December 18, 1953.

All other information is classified.



The Sikorsky HR2S-1.

THE SIKORSKY S-57

The designation S-57 has been given to a convertiplane which is the subject of an experimental contract placed under a joint U.S. Air Force/Army convertiplane development programme. No details of this project are available for publication.

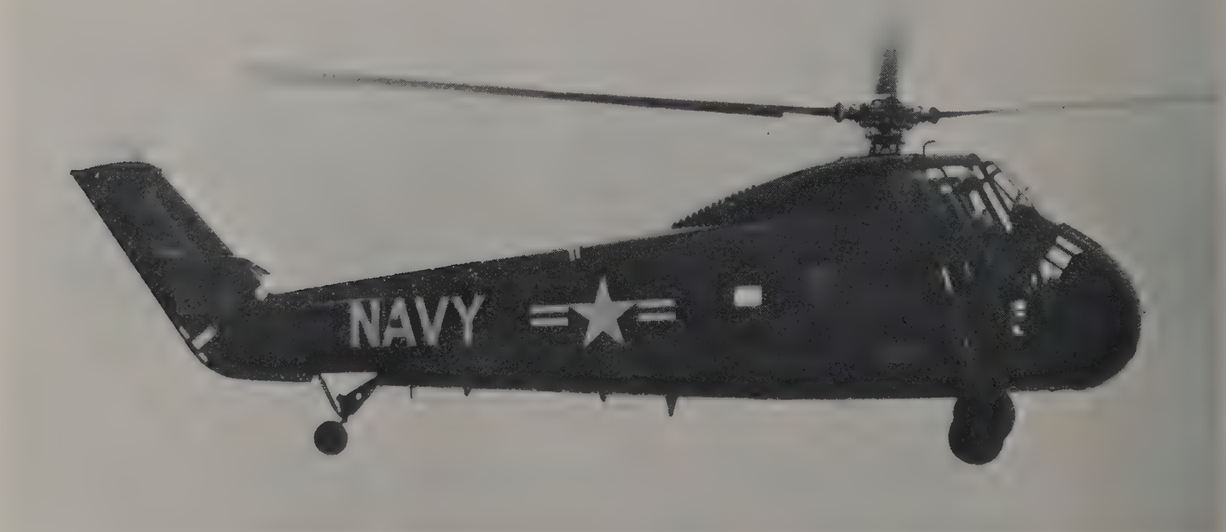
THE SIKORSKY S-58.
U.S. Navy designation: HSS-1.
U.S. Army designation: H-34.
U.S. Marine Corps designation: HUS-1.

The S-58 is an enlarged development of the S-55 and will be able to accommodate up to 12 passengers, or 1½ tons of cargo. It is powered by a 1,640 h.p. Wright R-1820 engine, driving a four-blade rotor. No further details available.

THE SIKORSKY S-59.
U.S. Army designation: H-39.

The S-59 is a development of the S-52 powered by a Turbomeca Artouste II shaft turbine. This installation has been tested with a modified S-52 known as the S-52-5 in which the original power-plant, a 245 h.p. Lycoming O-425-1, was replaced by an Artouste II mounted on top of the fuselage by being bolted direct to the transmission gear-box. Because of air-frame limitations, the Artouste II used in the S-52-5 was de-rated from a maximum take-off output of 400 h.p. to 320 h.p.

The ultimate design, the H-39, incorporates several design changes, notably



The Sikorsky HSS-1 Anti-submarine Helicopter (1,640 h.p. Wright R-1820 engine).

The Sikorsky XH-39 Helicopter (Turbomeca Artouste shaft-turbine engine). (*Gordon Williams*).

in the fuselage, to adapt it to the new power-plant.

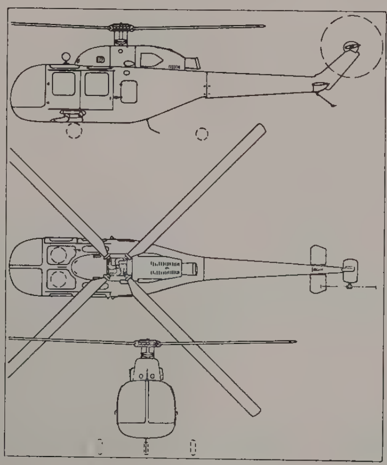
The 400 h.p. Artouste II engine, main transmission and rotor head form a complete package which is mounted above the fuselage and can be removed and re-installed in two hours.

The forward section of the fuselage contains the cabin which, in addition to the pilot, has 81 cub. ft. of payload space, offering adequate accommodation for three passengers and 100 lb. (45 kg.) of baggage, or two stretcher patients and a medical attendant, or 800 lb. (363 kg.) of cargo. The three-wheel retractable landing-gear forms part of this section.

The rear fuselage and the tail pylon, including the tail and intermediate gearboxes are quickly removable to facilitate rotational maintenance.

The four main rotor blades are completely interchangeable, as are the tail rotor blades. All blades are of all-metal construction.

On August 29, 1954, the prototype XH-39 set up a speed record over the 3-km. course at 156 m.p.h. (249.6 km.h.)



The Sikorsky H-39.

and on October 17, 1954, it established a new World's helicopter altitude record of 24,500 ft. (7,472.5 m.).

Dimensions.—
- Rotor diameter 35 ft. (10.67 m.).
- Overall length (rotors operating) 41 ft. 7 in. (12.68 m.).
- Length of fuselage 30 ft. 3 in. (9.22 m.).
- Height (over main rotor head) 9 ft. 8 in. (2.95 m.).
- Diameter of tail rotor 6 ft. 4 in. (1.9 m.).
- Width of fuselage 5 ft. (1.52 m.).
- Track of main wheels 8 ft. (2.44 m.).

Weights.—
- Weight empty 2,200 lb. (1,000 kg.).
- Weight loaded 3,560 lb. (1,616 kg.).

Performance.
- Max. speed 146 m.p.h. (234 km.h.).
- Cruising speed 138 m.p.h. (221 km.h.).
- Max. rate of climb at S/L. 730 ft./min. (223 m./min.).
- Vertical rate of climb at S/L. 800 ft./min. (244 m./min.).
- Hovering ceiling with ground effect 8,500 ft. (2,590 m.).
- Hovering ceiling without ground effect 7,000 ft. (2,135 m.).
- Service ceiling 16,000 ft. (4,880 m.).
- Cruising range with standard fuel and 10% reserve 250 miles (400 km.).

The Sikorsky XH-39 Helicopter (Turbomeca Artouste shaft-turbine engine).

STITS

STITS AIRCRAFT.

Head Office and Works: P.O. Box 3084, West Riverside, California.

Between 1948 and 1952 Mr. Ray Stits designed, built and tested his original single-seat experimental "midgets." The Stits Junior, a monoplane with a span of 8 ft. 10 in. was superseded by the Sky Baby biplane with a span of only 7 ft. 2 in. They have been respectively described by their designer as the "World's Smallest."

The third design, the Model SA-3 Playboy, has appeared in single-seat form as the SA-3A and is planned as a side-by-side two-seat monoplane as the SA-3B. The Playboy is designed for the sportsman pilot who wishes to assemble from pre-fabricated parts.

The most recent design is the Stits-Beslar Executive, a three-seat cabin monoplane, designed and built by Mr. Stits for Mr. William Beslar of the Beslar

Corporation, Oakland, California.' The Executive will be used to test the current market potential for a trailer-towed folding wing monoplane.

THE STITS SA-3A PLAYBOY.

TYPE.—Single-seat "home assembly" monoplane.

WINGS.—Strut-braced low-wing monoplane. Constant chord structure with spruce spars, plywood ribs, plywood-covered leading-edge and overall fabric covering. Steel tube bracing struts. Ailerons are of wooden construction and fabric-covered. Wing area 96 sq. ft. (8.9 m.²).

FUSELAGE.—Chrome-molybdenum steel tube framework with fabric covering.

TAIL UNIT.—Wire-braced monoplane type. Controllable trim-tab in port elevator only.

LANDING GEAR.—Fixed tail-wheel type. Oleo shock-absorbers. Spats are optional. Leaf-spring tailwheel.

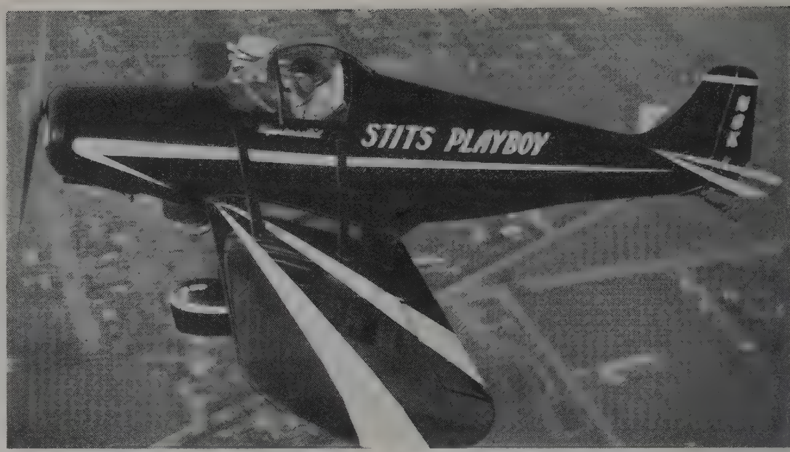
POWER PLANT.—One 85 h.p. Continental C85 four-cylinder horizontally-opposed air-cooled engine. Engine mounting standard for Continental range of engines from A65 to C90. Wooden two-blade fixed-pitch airscrew. Fuel capacity 14 U.S. gallons (53 litres).

ACCOMMODATION.—Single-seat open cockpit (enclosed hood optional).

DIMENSIONS.—
Span 22 ft. 2 in. (6.76 m.).
Length 17 ft. 4 in. (5.28 m.).

WEIGHTS AND LOADINGS.—
Weight empty 600 lb. (272 kg.).
Disposable load 302 lb. (137 kg.).
Weight loaded 902 lb. (409 kg.).
Wing loading 9.0 lb./sq. ft. (43.92 kg./m.²).
Power loading 10.6 lb./h.p. (4.81 kg./h.p.).

PERFORMANCE.—
Max. speed 150 m.p.h. (241 km.h.).
Cruising speed 135 m.p.h. (216 km.h.).
Stalling speed 43 m.p.h. (69 km.h.).
Initial rate of climb 1,400 ft./min. (427 m./min.).
Service ceiling over 12,000 ft. (3,660 m.).
Take-off (against 10 m.p.h. wind) 150 ft. (46 m.).



The Stits SA-3A Playboy (85 h.p. Continental C85 engine).

THE STITS SA-3B PLAYBOY.

This is a two-seat version of the SA-3A fitted with dual controls and an electrical system. Power is increased by 30 h.p. by installing a 115 h.p. Lycoming O-235 engine.

THE STITS-BESLAR EXECUTIVE.

TYPE.—Three-seat Cabin monoplane.

WINGS.—Braced low-wing monoplane. Constant chord fabric-covered structure with inverted-Vee struts on each side of the fuselage. Time required to fold wings manually is stated to be 30 seconds. Wing area 120 sq. ft. (11.14 m.²).

FUSELAGE.—Steel-tube structure with fabric covering.

TAIL UNIT.—Wire-braced monoplane type. Fabric covering.

LANDING GEAR.—Fixed tail-wheel type. Oleo shock absorber struts. Steerable tail-wheel.

POWER PLANT.—One 150 h.p. Lycoming four-cylinder horizontally-opposed air-cooled engine. Two-blade fixed-pitch wooden airscrew. Fuel capacity 24 U.S. gallons (91 litres).

ACCOMMODATION.—Cabin seats three, two side-by-side in front and one in rear. Entry door on starboard side.

DIMENSIONS.—
Span 25 ft. 6 in. (7.77 m.).
Span (wings folded) 7 ft. 5 in. (2.25 m.).
Length 18 ft. 6 in. (5.64 m.).
Height (wings folded) 6 ft. 11 in. (2.1 m.).

WEIGHTS AND LOADINGS.—
Weight empty 800 lb. (363 kg.).
Disposable load 650 lb. (295 kg.).
Weight loaded 1,450 lb. (658 kg.).
Wing loading 12.8 lb./sq. ft. (62.46 kg./m.²).
Power loading 9.6 lb./h.p. (4.34 kg./h.p.).

PERFORMANCE.—
Max. speed 165 m.p.h. (264 km.h.).
Cruising speed 150 m.p.h. (240 km.h.).
Stalling speed 50 m.p.h. (80 km.h.).
Initial rate of climb 2,500 ft./min. (760 m./min.).

The Stits-Beslar Executive (150 h.p. Lycoming O-320 engine).

STROUKOFF

STROUKOFF AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: WEST TRENTON, NEW JERSEY.

President and Chief Engineer: Michael Stroukoff.

Assistant Chief Engineer: L. J. Stowe.

Treasurer and Comptroller: J. X. Cousins.

The Stroukoff Aircraft Corporation was formed by Mr. Stroukoff after the controlling interest in the Chase Aircraft Company, Inc., of which he was Vice-President and Chief Engineer, was acquired by the Kaiser-Frazer Corporation. Mr. Stroukoff was responsible for the design of the Chase C-123. A production order for 300 C-123B's held by the Kaiser-Frazer Corporation was cancelled in 1953. New bids were asked for, as a result of which production of the C-123B was assigned to the Fairchild Engine and Airplane Corporation, to which reference should be made for a description of the C-123B.

The Stroukoff Aircraft Corporation is undertaking considerable development work with the basic C-123 design. The company was awarded a U.S.A.F. contract for the construction and development of a test version of the C-123 fitted with boundary-layer control. The first aircraft so equipped, the XC-123D, first flew on December 7, 1954. Preliminary tests at the Wright Air Development Center showed that with boundary-layer control the take-off distance of the XC-123D at 50,000 lb. (22,700 kg.) A.U.W. was reduced from 1,950 ft. (595 m.) to 850 ft. (250 m.) and the landing run from 1,200 ft. (366 m.) to 755 ft. (230 m.). Six more XC-123D's are under construction for the U.S.A.F.

A further Stroukoff development of the C-123 is the YC-123E which is fitted with a so-called "pantobase" landing-gear which enables it to take-off from and alight on water, sand, swamp, snow, ice and almost any unprepared but fairly smooth natural surface.

The YC-123E, which has its fuselage sealed for flotation, is fitted with a pair of heavily-stressed retractable land and water skis and wing-tip floats. The aircraft's retractable nose-wheel landing-gear is retained for runway operation. For take-off from water the skis are lowered and at about 20 m.p.h. (32 km.h.) they surface by means of aerofoils on their sides and skim the water until flying speed is reached.

With the pantobase gear the YC-123E retains all the assault transport characteristics of the C-123B. Cruising speed is reduced by about 2 per cent., mainly by the addition of the fixed wing-tip floats.

TAYLORCRAFT

TAYLORCRAFT, INC.

HEAD OFFICE AND WORKS: CONWAY-PITTSBURGH AIRPORT, CONWAY, PA.

President: B. J. Mauro.
Vice-President: C. G. Taylor.
Chief Engineer: J. Gilberti.
Production Manager: C. Hodgekin.
Export Manager: Howard Barnhouse.

Taylorcraft, Inc is the successor to the Taylorcraft Aviation Corporation which went bankrupt in 1946. It was reformed by Mr. C. G. Taylor, founder of the original Taylor Aircraft Company and designer of the original Cub light cabin monoplane, who acquired the assets of the defunct Taylorcraft concern at a public auction.

In 1955 Taylorcraft introduced a new form of structure for light aircraft using moulded Fiberglas as a covering for fuselage and wings as well as for the engine cowling, doors, seats, fuel tanks, instrument panel, etc. Only the rudder and elevators are fabric-covered.

This new material, which is supplied by the Owens Corning Fiberglas Corporation, combines great strength with light weight and almost complete resistance to corrosion. It will not dent, warp or

tear, and presents a superfine external finish.

The first two aircraft incorporating this form of construction are the Ranch Wagon and the Topper, described below.

THE TAYLORCRAFT MODEL 20 RANCH WAGON.

TYPE.—Four-seat light cabin monoplane, quickly convertible for light cargo-carrying.

WINGS.—High-wing rigidly-braced monoplane. Wing section Goëttingen 532. Aspect ratio 7.11. Dihedral 1°. Chord 6 ft. $2\frac{1}{4}$ in. (1.89 m.). Two-spar light alloy structure covered with moulded Fiberglas skin. All-aluminium slotted flaps and ailerons. Slotted wing-tips. Total area of flaps 14.3 sq. ft. (1.33 m.^{2})· Total area of ailerons 14.38 sq. ft. (1.36 m.^{2}). Gross wing area 178.5 sq. ft. (16.58 m.^{2}).

FUSELAGE.—Welded steel tube framework. Fiberglas covering is moulded in two half sections extending from fireproof bulkhead to rudder-post, including fin, and is attached directly to fuselage framework and upper and lower joints sealed.

TAIL UNIT.—Braced monoplane type. Fin integral with fuselage. Welded steel tube frames for tailplane, elevators and rudder, the tailplane covered with Fiberglas and the elevators and rudder with fabric. Areas: fin 9.35 sq. ft. (0.86 m.^{2}), rudder 9.36 sq. ft. (0.87 m.^{2}), tailplane 15.84 sq. ft. (1.47 m.^{2}), elevators 13.98 sq. ft. (1.29 m.^{2}). Span of tail 11 ft. $10\frac{1}{2}$ in. (3.63 m.).

LANDING GEAR.—Fixed tail-wheel type. Two faired side vees and two half axles, the latter fitted with air-oil shock-absorbers. Cleveland wheels and C2000H brakes. Steerable tail-wheel. Track 6 ft. 3 in. (1.90 m.).

The Taylorcraft Ranch Wagon (225 h.p. Continental O-470 engine).

POWER PLANT.—One 225 h.p. Continental 470-J six-cylinder horizontally-opposed air-cooled engine. McCauley metal fixed-pitch airscrew. Optionally Hartzell or McCauley constant-speed airscrew can be fitted. Three Fiberglas fuel tanks (22 U.S. gallons = 83 litres). Total fuel capacity 66 U.S. gallons (250 litres). Oil capacity 3 U.S. gallons (11.3 litres).

ACCOMMODATION.—Enclosed cabin seats four, two in front with dual wheel controls. Individual rear seats can be instantly removed to provide cargo space. The starboard front seat alongside the pilot can also be removed and the space made available for cargo. Large baggage compartment behind rear seats. Doors on either side of front seats, and a special wide cargo door may be installed on starboard side of rear compartment.

DIMENSIONS.—
Span 34 ft. 8 in. (10.57 m.).
Length 24 ft. 4 in. (7.42 m.).
Height 7 ft. $1\frac{1}{16}$ in. (2.16 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,625 lb. (738 kg.).
Disposable load 1,125 lb. (511 kg.).
Weight loaded 2,750 lb. (1,249 kg.).
Wing loading 15.4 lb./sq. ft. (75.15 kg./m.^{2}).
Power loading 12.2 lb./h.p. (5.54 kg./h.p.).

PERFORMANCE (constant-speed airscrew).—
Max. speed 160 m.p.h. (256 km.h.).
Cruising speed 150 m.p.h. (240 km.h.).
Initial rate of climb 1,000 ft./min. (305 m./min.).
Service ceiling 15,000 ft. (4,575 m.).
Cruising endurance 5 hours.

THE TAYLORCRAFT MODEL 20AG TOPPER.

The Topper is similar to the Ranch Wagon but is intended for agricultural use. Provision is made for the installation of a dust hopper or spray tank in the rear half of the cabin and there is a power take-off on the engine for operating a spray pump. The pilot is seated centrally in front and has stick control. There is one door on the right side of the front compartment.

The structure, power-plant and dimensions of the Topper and Ranch Wagon are identical. The Topper has two Fiberglas fuel tanks with a total capacity of 46 U.S. gallons (174 litres).

DIMENSIONS.—
Same as Ranch Wagon.

WEIGHTS AND LOADINGS.—
Weight empty 1,550 lb. (704 kg.).
Weight loaded 2,750 lb. (1,249 kg.).
Wing loading 15.4 lb./sq. ft. (75.15 kg./m.^{2}).
Power loading 12.2 lb./h.p. (5.54 kg./h.p.).

PERFORMANCE.—
Max. speed 115 m.p.h. (184 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Initial rate of climb 1,000 ft./min. (305 m./min.).
Service ceiling 15,000 ft. (4,575 m.).

The Taylorcraft Topper Agricultural Duster and Sprayer.

TEMCO

TEMCO AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: P.O. Box 6191, DALLAS 2, TEXAS.

OTHER FACTORIES: GARLAND AND GREENVILLE, TEXAS.

President and General Manager: Robert McCulloch.

Executive Vice-President and Treasurer: H. L. Howard.

Vice-President, Comptroller: Clyde Williams.

Vice-President, Manufacturing: J. A. Maxwell, Jr.

Vice-President, Engineering: I. Nevin Palley.

Secretary: Latham Leeds.

The major activities of the Temco Aircraft Corporation are devoted to the manufacture of complete aircraft and major sub-assemblies. Temco holds contracts for the manufacture of major sub-assemblies for the Boeing B-52 and B-47; McDonnell F3H and F-101; Lockheed P2V and Republic F-84.

At its overhaul and modification centre at Greenville, Texas, the company is converting Navions into Riley 55's and is overhauling and modifying four different trainer and transport types for the U.S.A.F.

At its Dallas plant Temco is re-conditioning Lockheed R7V Super Constellations and Douglas R6D's for the U.S. Navy.

THE TEMCO RILEY 55.

The Riley 55 is a conversion of the well-known four-seat Navion into a twin-engined aircraft. The first conversion—designated the Riley Twin—was completed by the Riley Aircraft Company in April, 1952, and the type received its Approved Type Certificate early in 1953.

Conversion included installing two Lycoming engines in wing nacelles; reinforcing the original wing to support the engine nacelles; fitting a new nose to the fuselage, a new vertical tail surface and a new control pedestal and instrument panel, while there are many other changes in furnishings and equipment.

Production of the Riley Twin was begun by Temco in April, 1953, under a contract with the Riley Aircraft Company. Later, Temco fitted the Riley Twin with 150 h.p. engines in place of the original 140 h.p. power-units, and increased the aircraft's gross weight from 2,950 lb. (1,340 kg.) to 3,350 lb. (1,521 kg.).

In December, 1953, Temco purchased the exclusive engineering and conversion rights for the Riley Twin.

In 1954 Temco introduced the Riley 55, an improved version of the Riley Twin, the prototype flying for the first time on September 1, 1954. The new conversion has 170 h.p. Lycoming engines,

The Temco Riley 55 (two 170 h.p. Lycoming O-340 engines).

an all-up weight of 3,600 lb. (1,634 kg.) and optional wing-tip tanks which extend the range to 1,200 miles (1,920 km.). The Riley 55 is now in production at Temco's Greenville plant. The first production aircraft flew on February 23, 1955.

TYPE. Twin-engined four-seat cabin monoplane.

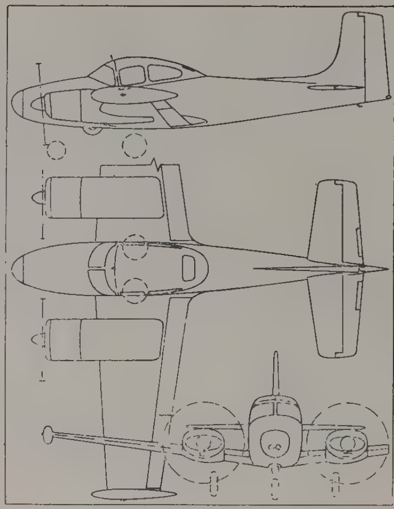
WINGS.—Low-wing cantilever monoplane. Wing section NACA 4415R at root, NACA 6410R at tip. Aspect ratio 4.04. Dihedral 7½°. Incidence +2° at root, —1° at tip. Chord 7 ft. 2½ in. (2.20 m.) at root, 3 ft. 10 in. (1.17 m.) at tip. All-metal structure with 24ST aluminium skin. Ailerons and flaps as for Navion. Gross wing area 178.3 sq. ft. (16.5 m.²).

FUSELAGE.—All-metal structure as for Navion except for addition of new nose.

TAIL UNIT.—Cantilever monoplane type. Tailplane and elevators as for Navion. Fin and rudder are modified versions of half of Navion tailplane and one elevator. Areas: fin 14.8 sq. ft. (1.37 m.²), rudder 10.2 sq. ft. (0.95 m.²). Other areas and tailplane span as for Navion.

LANDING GEAR.—Retractable nose-wheel type. Same as for Navion, except higher heat treatment for main air/oil shock-absorber units. Hydraulic retraction. Wheelbase 5 ft. 8½ in. (1.73 m.). Track 8 ft. 2½ in. (2.49 m.).

POWER PLANT.—Two 170 h.p. Lycoming O-340-A1A four-cylinder horizontally-opposed air-cooled engines. Hartzell constant-speed full-feathering airscrews. Main tank in centre wing section (39.5 U.S. gallons = 149 litres) and two auxiliary tanks, one in each engine nacelle (32.5 U.S. gallons = 123 litres each). Total internal fuel capacity 104.5 U.S. gallons (395 litres). Two wing-tip tanks (20 U.S. gallons = 76 litres each) optional.



The Temco Riley 55.

ACCOMMODATION.—Enclosed cabin seats four in two pairs, front pair with dual controls. Generally similar to Navion but with new control pedestal and instrument board. Baggage compartment aft of rear seats with access from cabin.

DIMENSIONS.—
Span 33 ft. 4½ in. (10.18 m.).
Span over tip tanks 33 ft. 10½ in. (10.33 m.)
Length 27 ft. 2 in. (8.28 m.).
Height 9 ft. 6½ in. (2.90 m.).

WEIGHTS.—
Weight empty 2,350 lb. (1,067 kg.).
Weight loaded 3,600 lb. (1,634 kg.).

PERFORMANCE (at 3,600 lb. = 1,634 kg. A.U.W.).—
Max. speed 180 m.p.h. (288 km.h.).
Cruising speed (70% power) at 7,000 ft. (2,135 m.) 170 m.p.h. (272 km.h.).
Initial rate of climb 1,400 ft./min. (427 m./min.).
Service ceiling 20,000 ft. (6,100 m.).
Service ceiling on one engine 6,000-8,000 ft. (1,830-2,440 m.).
Landing speed (with flaps) 58 m.p.h. (92.8 km.h.).
Landing speed (without flaps) 62 m.p.h. (99.2 km.h.).
Take-off distance to clear 50 ft. (15.25 m.) at S/L. no wind 1,150 ft, (350 m.).
Landing distance from 50 ft. (15.25 m.) at S/L. no wind 1,050 ft. (320 m.).
Range without tip tanks (70% power—106 U.S. gallons = 400 litres total fuel) 900 miles (1,440 km.).
Range with tip tanks (70% power—146 U.S. gallons = 552 litres total fuel) 1,200 miles (1,920 km.).

TEXAS A. & M. COLLEGE

PERSONAL AIRCRAFT RESEARCH CENTER, AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS.

ADDRESS: COLLEGE STATION, TEXAS.
Director: Fred E. Weick.

A programme of research on agricultural aviation problems is being undertaken at the Personal Aircraft Research Center of the A. and M. College of Texas. This programme, which was initiated by the National Flying Farmers Association, in co-operation with the Civil Aeronautics Administration, the Department of Agriculture and the A. and M. College of Texas, includes the development of aircraft specifically designed for dusting, spraying, seeding and fertilising, and improved dispersing equipment.

An aircraft was designed and built under a C.A.A. contract which became effective on December 7, 1949, and this aircraft, the Ag-1, made its first flight on December 1, 1950. This project was aided by personnel assigned for various periods by the C.A.A., the Department of Agriculture, two aircraft manufacturers and the Texas A. and M. College, and many important parts and components, including the engine, airscrew, landing-gear, seat, etc., were contributed by their manufacturers.

The Ag-1, which has been fully described and illustrated in previous editions of "All the World's Aircraft" was destroyed in June, 1953, when it was accidentally flown into a power-line cable.

A modification of the Ag-1, designated the Ag-2, has been developed for commercial production by the Transland Company, 223, California Street, El Segundo, California. (See page 319).

In the meantime the Personal Aircraft Research Center has developed a smaller aircraft, the Ag-3, brief details of which follow.

THE Ag-3.

The Ag-3 is an experimental aircraft which has been designed to carry a spray or dust load of 800 lb. (365 kg.) with a 135 h.p. engine. It is smaller in size and cheaper in cost than the Ag-1, is fabric covered and makes use of a number of standard Piper parts.

TYPE.—Single-seat Experimental Agricultural monoplane.

WINGS.—Low-wing rigidly-braced monoplane. U.S.A. 35B wing section. Chord 5 ft. 3 in. (1.60 m.). Dihedral 6°. Incidence 2°. Metal two-spar frame with fabric covering. Total aileron area 16 sq. ft. (1.48 m.²). Gross wing area 183 sq. ft. (17.0 m.²).

FUSELAGE.—Steel tube fabric-covered structure. Removable panels on whole underside and forward portion of sides.

TAIL UNIT.—Welded steel tube framework covered with fabric. Areas: fin 4 sq. ft. (0.37 m.²), rudder 7.4 sq. ft. (0.69 m.²), tailplane 17 sq. ft. (1.58 m.²), elevators 13 sq. ft. (1.21 m.²). Span of tail 10 ft. 6 in. (3.20 m.).

LANDING GEAR.—Fixed tail-wheel type with provision for conversion to tricycle type. Oleo and rubber cord springing. Wheels, tyres and brakes same as for Piper PA-20 Pacer. Track 6 ft. 10 in. (2.07 m.²).

POWER PLANT.—One 135 h.p. Lycoming O-290 four-cylinder horizontally-opposed air-cooled engine. Sensenich one-piece metal airscrew. Fuel tank (40 U.S. gallons = 151 litres) in fuselage.

ACCOMMODATION.—Single cockpit may be either closed or open. Same pilot safety characteristics with regard to structural protection and field of view as in Ag-1. 18 cub. ft. (0.51 m.³) hopper for 800 lb. (365 kg.) load of chemical, etc. in front of cockpit. Distribution equipment as in Ag-1.

DIMENSIONS.—
Span 36 ft. 2 in. (11.03 m.).
Length 23 ft. 7 in. (7.19 m.).
Height 6 ft. 10 in. (1.88 m.).

WEIGHTS.—
Weight empty 1,035 lb. (470 kg.).
Weight loaded 2,300 lb. (1,044 kg.).

PERFORMANCE.—
Max. speed 124 m.p.h. (198 km.h.).
Take-off to clear 50 ft. (15.25 m.) with full hopper load and 10 U.S. gallons (37.8 litres) of fuel (zero wind) 920 ft. (281 m.). (Corrected to standard S/L. air).

TRANSCENDENTAL

TRANSCENDENTAL AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: GLEN RIDDLE, PENNSYLVANIA,
President: William E. Cobey.

This small company is engaged in the development of convertiplanes. The original Model 1, which employs two 17-foot rotors which can be swivelled through 84° to provide either lift for vertical flight or thrust for horizontal flight, was designed in 1945 and completed in 1951. Development of the aircraft has progressed through ground tests and modifications to the Model 1-G which, at the time of writing had made successful free vertical flights, the first being achieved on June 15, 1954.

Although the development of the Transcendental convertiplane has been mostly privately financed, considerable assistance has been forthcoming through various U.S.A.F. contracts.

In 1952 the company was awarded a contract to investigate the dynamic and structural characteristics of the rotor system. The primary purpose of these tests was to study the action of the rotors during simulated conversion. An additional contract was awarded in 1953 to investigate mechanical instability problems when tilting the rotors of the

The Transcendental Model 1-G Experimental Convertiplane. (*Howard Levy*).

The Transcendental Model 1-G Experimental Convertiplane on hovering flight. (*Howard Levy*).

convertiplane. This contract was continued to include limited flight tests.

The Model 1-G, which is illustrated and described hereafter, is strictly a single-seat research aircraft intended to investigate the conversion problems of a convertiplane.

THE TRANSCENDENTAL MODEL I-G.

Type.—Single-seat Experimental Convertiplane.

Rotor System.—Two three-blade rotors mounted at tips of fixed wings are arranged to be tilted from horizontal (vertical flight) to point 6° forward of vertical (forward flight) by electric motors. Rotor diameter 17 ft. (5.18 m.). Chord of rotor blades 4 in. (101.6 mm.). Blades have extruded 75 ST aluminium-alloy spar, 24 ST ribs, trailing-edge and skin. Rotors interconnected to ensure simultaneous tilting. Hubs fully articulated. Controls for collective and cyclic pitch run through wings and over chain and sprocket drive at tips to rotor heads. Rotor transmission from gear-box in front of engine, through span-wise shafts to bevel gearing at wing tips to rotor heads. Two-speed gear in rotor drive to give required r.p.m. for vertical and forward flight.

Wings.—Cantilever monoplane. NACA 23015 wing section. Aspect ratio 7 : 1. Incidence 4°. Chord 3 ft. (0.915 m.). Aluminium-alloy structure. Ailerons have metal frames and fabric covering. Total aileron area 4 sq. ft. (0.37 m.²). Gross wing area 63 sq. ft. (5.85 m.²).

Fuselage.—Steel tube forward structure aluminium-alloy monocoque tail cone.

Tail Unit.—Cantilever monoplane type. All-metal structure. Areas: fin 4 sq. ft. (0.37 m.²), rudder 2 sq. ft. (0.186 m.²), tailplane 5 sq. ft. (0.46 m.²), elevators 4 sq. ft. (0.37 m.²). Span of tail 6 ft. 6 in. (1.98 m.).

Landing Gear.—Fixed nose-wheel type. Transcendental air-oil shock-absorbers. Wheelbase 6 ft. (1.83 m.). Track 8 ft. (2.44 m.),

Power Plant.—One 160 h.p. Lycoming O-290-A six-cylinder horizontally-opposed air-cooled engine. Fuel capacity 14 U.S. gallons (53 litres).

Accommodation. — Pilot's semi-enclosed nacelle forward of wings.

Dimensions.—
- Span of wings 21 ft. (6.40 m.).
- Overall length of fuselage 26 ft. (7.93 m.).
- Height 7 ft. (2.13 m.).

Weights and Loadings.—
- Weight empty 1,450 lb. (658 kg.).
- Weight loaded 1,750 lb. (794 kg.).
- Disc loading 3.6 lb./sq. ft. (17.54 kg./m.²).
- Wing loading 27.7 lb./sq. ft. (135.17 kg./m.²).
- Power loading 10.93 lb./h.p. (4.96 kg./h.p.).

Performance (estimated).—
- Max. speed as helicopter 120 m.p.h. (192 km.h.).
- Max. speed as aeroplane 160 m.p.h. (256 km.h.).
- Ceiling as aeroplane 5,000 ft. (1,525 m.).
- Endurance 1½ hours,

TRANSLAND

TRANSLAND COMPANY.

Head Office and Works: 308, Hindry Avenue, Inglewood, California.

President: George S. Wing.

Project Engineer: Nelson M. Rogers.

The Transland Company, a subsidiary of the Hi-Shear Rivet Tool Company of Los Angeles, California, has for several years been a leading manufacturer of equipment to convert surplus trainers into crop-dusting aircraft. It is now undertaking the manufacture of complete aircraft for agricultural use, its first aircraft being the Ag-2.

The Ag-2 was designed under the direction of George S. Wing, President of the Transland Company, and Nelson M. Rogers, project engineer, with Professor Fred E. Weick of the Personnel Aircraft Research Center of the Texas Agricultural and Mechanical College, designer of the Ag-1, being retained as consultant. The Ag-1, which was purely a research vehicle, was fully illustrated and described in the 1953-54 edition of "All The World's Aircraft."

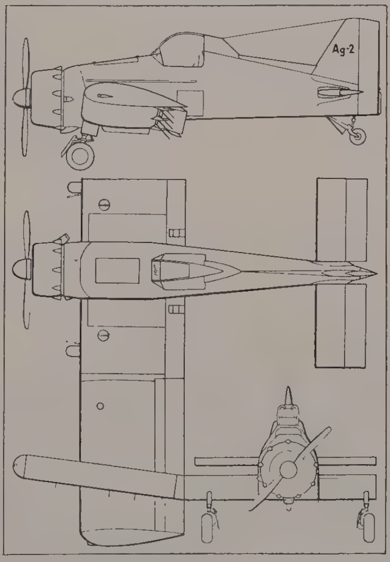
The Ag-2 was designed round the applicating equipment of proven Transland design. It is intended for use not only over cultivated fields but also in the treatment of infested forests, the restoration of range lands by application of top dressings and the control of noxious plants.

At the time of writing, five prototype Ag-2's were being built and first flights were scheduled to take place before the end of 1955.

THE TRANSLAND Ag-2.

Type.—Single-seat Agricultural monoplane.

Wings.—Low-wing cantilever monoplane. NACA 64021 high-lift wing section. Aspect ratio 5.53. Chord 7 ft. 6 in. (2.28 m.). Dihedral 8°. Incidence 4°. All-metal structure of riveted 24ST aluminium-alloy. Wing in four sections, comprising two inner sections, which contain the Fiberglas spray tanks, and two outer sections, containing the two cell-type fuel tanks. Full-span slotted flaps, the outer wing flaps with slot lips serving as ailerons.



The Transland Ag-2.

When flaps are lowered the elevators are automatically trimmed. Total area of flaps 69.35 sq. ft. (6.44 m.²). Total area of ailerons 44.9 sq. ft. (4.17 m.²). Gross wing area 319 sq. ft. (29.63 m.²).

Fuselage. — All-metal semi-monocoque structure of riveted 24ST aluminium-alloy. All internal structure is zinc-chromate primed or otherwise protected with finishes impervious to corrosive agricultural chemicals.

Tail Unit.—Cantilever monoplane type. All-metal construction. Areas: fin 11.10 sq. ft. (1.03 m.²), rudder 11.90 sq. ft. (1.10 m.²), tailplane 53.80 sq. ft. (4.99 m.²), elevators 23.43 sq. ft. (2.17 m.²). Tailplane span 14 ft. 4 in. (4.37 m.).

Landing Gear.—Fixed tail-wheel type. United Aircraft air/oil shock struts. Goodrich wheels and smooth-contour tyres. Hayes hydraulic drum-type brakes. Goodrich low-pressure tail-wheel tyre. Wire cutting blades attached to shock struts. Track 10 ft. 10 in. (3.3 m.).

Power Plant.—One 450 h.p. Pratt & Whitney R-985 Wasp Jr. radial air-cooled engine. Hamilton Standard 2030-227 two-position airscrew 9 ft. (2.74 m.) diameter. Cell-type fuel tank (62.5 U.S. gallons = 236 litres) in each outer wing.

Accommodation.—Pilot's cockpit over trailing-edge of wing. Reinforced wind-shield frame extends over cockpit to serve as wire deflector, heavy turnover structure behind pilot's seat, from which deflector wire extends to top of fin. Pilot's seat and shoulder harness stressed to take 40G load. If desired sliding canopy can be provided. Cockpit sealed to prevent dust or liquid penetration.

Equipment.—Dust hopper 53 cub. ft. = 1.5 m.³) an integral part of fuselage forward of cockpit. Two non-corrosive plastic spray tanks (250 U.S. gallons = 945 litres total capacity), one in each inner wing. Dust dispersal through rotary gate in underside of fuselage, pattern and swath width

being controlled by adjustable vanes. Spray system operated by engine-driven pump through non-corrosive external piping and spray nozzles along wing trailing-edge. Drive for dust gate agitator and spray pump taken from gear-box on engine starter pad. Simple clutch system enables pilot to actuate either dust or spray system and either system controlled by single lever.

DIMENSIONS.—
Span 42 ft. (12.8 m.).
Length 27 ft. 11 in. (8.56 m.).
Height 9 ft. 8 in. (2.95 m.).

WEIGHTS.—
Weight empty 2,745 lb. (1,246 kg.).
Payload 2,000 lb. (908 kg.).
Disposable load 2,455 lb. (1,114 kg.).
Weight loaded 5,200 lb. (2,360 kg.).

PERFORMANCE.—
Cruising speed (no payload) at 58% power 122 m.p.h. (195 km.h.).
Cruising speed (2,000 lb. = 908 kg. payload) at 58% power 110 m.p.h. (176 km.h.).
Landing speed (no payload), zero wind 48 m.p.h. (76.8 km.h.).
Landing speed (2,000 lb. = 908 kg. payload), zero wind 66 m.p.h. (105.6 km.h.).
Initial rate of climb (no payload) 900 ft./min. (275 m./min.).
Initial rate of climb (2,000 lb. = 908 kg. payload) 1,920 ft./min. (586 m./min.).
Take-off distance to 50 ft. (15.25 m.) no payload 450 ft. (165 m.) 1,000 lb. (454 kg.) payload 800 ft. (244 m.) 2,000 lb. (908 kg.) payload 940 ft. (286 m.).
Landing distance from 50 ft. (15.25 m.) no payload 1,000 ft. (305 m.) 1,000 lb. (454 kg.) payload 1,230 ft. (375 m.) 1,500 lb. (681 kg.) payload 1,340 ft. (409 m.) 2,000 lb. (908 kg.) payload 1,440 ft. (440 m.).

A drawing of the Transland Ag-2 Agricultural Monoplane.

YUGOSLAVIA

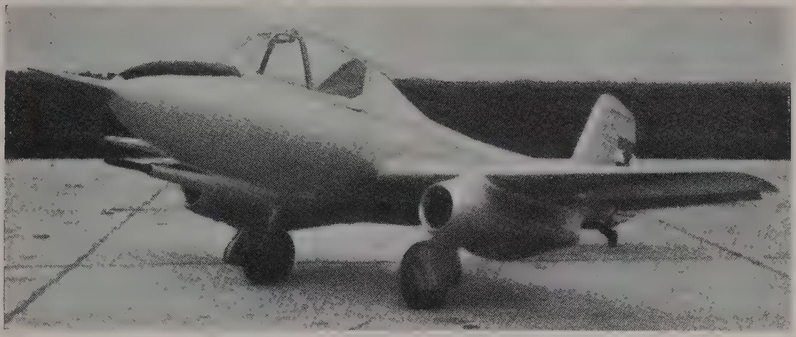
GOVERNMENT FACTORIES

The Yugoslav aircraft industry consists essentially of a central national research, design and prototype manufacturing and testing establishment, and a number of purely production factories.

Before the war the Yugoslav aircraft industry was made up of three main firms, Ikarus A.D. with factories at Novi Sad and Zemun; Prva Srpska Fabrika Aeroplana Zivojin Rogojarsky with a factory at Belgrade; and Fabrika Aeroplana i Hidroplana "Zmaj" with a factory at Zemun. All these factories, in addition to building aircraft of various types under licence, including the Potez 25, Hawker Fury, Bristol Blenheim, Dewoitine D.27, Gourdou-Leseurre B.3 and Hanriot training aircraft, produced a variety of types of original design, most of which were illustrated and described in the inter-war editions of "All the World's Aircraft."

During the German occupation all these factories were destroyed and it was not until 1945 that the Ikarus plant at Zemun was sufficiently rebuilt and re-equipped to be able to resume aircraft work. As a nationalised plant it began with the repair and overhaul of YaK-3, YaK-9 and IL-2 Stormovik aircraft belonging to the Sovietised Yugoslav Air Force.

In August, 1946, the remnants of the former Ikarus, Rogojarsky and "Zmaj" companies and their surviving technical staffs were incorporated in the national concern and the design and manufacture of aircraft was resumed.



The Type 451-M (two Turbomeca Palas turbojet engines).

Two other types produced in 1951 were the Type 214 designed by Eng. Prof. Milutinovic and the Type 215, designed by Eng. Stankov, both twin-engined aircraft intended for training and general purpose duties. The former was selected for production for the Air Force as an aircrew trainer.

A 1949 prototype, the Type 213 two-seat advanced trainer, has recently been modified and fitted with a 600 h.p. Pratt & Whitney Wasp engine, and as the Type 522 has been put into production.

Recent prototypes built at Zemun, near Belgrade, include the Pionir, a small research monoplane for experiments with a prone pilot position; the Type 451, a larger development of the Pionir; the Type 451-M, which was Yugoslavia's first jet-propelled aircraft; and the type 452, which is also jet propelled.

The Pionir Research Monoplane (two 65 h.p. Walter Mikron engines).

The first post-war aeroplane of original design was the Aero-2 designed by Engineers Cijan and Petkovic, a two-seat trainer, the prototype of which first flew in October, 1946. This aircraft, which was produced in quantity for the Yugoslav Air Force, was developed through various versions with differing power-plants.

At about the same time the C-3, designed by Cijan and Petkovic, won a competition for a light trainer suitable for use by national flying clubs and schools and was also put into production.

Before the break with the Cominform the only military aircraft built in Yugoslavia were of Russian design. The Ilyushin IL-2 was built in series, and trainer versions of the IL-2 and YaK-3 were also developed and built.

Since the break, however, Yugoslavia has undertaken the design and construction of its own military aircraft. The first example was the S-49, a re-design of the YaK-9 by Sivčev, Zrnic and Popovic. This aircraft has been developed through the S-49A fitted with the Russian VK-105 copy of the Hispano-Suiza 12Y engine, to the S-49C which is powered by the French-built Hispano-Suiza 12Z of greater power.

THE PIONIR (PIONEER).

The Pionir is a very small research monoplane which was designed by Major D. Beslin to investigate problems associated with the prone pilot position. It is powered by two 65 h.p. Walter Mikron III engines. No further details are available.

THE TYPE 451.

The Type 451 is a larger development of the Pionir with two 160 h.p. Walter Minor 6-III engines. It also has the prone position for the pilot. No other details are available.

THE TYPE 451-M.

Designer.—Major Dragoljub Beslin.

The 451-M (M=Mlazni, *i.e.* jet) is a jet-powered conversion of the Type 451 light twin-engined research monoplane. The conversion consisted of replacing the piston engines by two Turbomeca Palas turbojets to evolve the first jet-powered aircraft of national design. Unlike the Type 451, this version has the pilot in the normal position with a raised cockpit canopy. No other details are available.

Dimensions (Approx.).—
Span 6.7 m. (22 ft.).
Length 7.4 m. (24 ft. 3 in.).

Loaded Weight.—
1,350 kg. (2,970 lb.).

THE TYPE 452-2.

Designer.—Major Dragoljub Beslin.

The 452 is a single-seat research aircraft with swept wings and tail surfaces and is powered by two Turbomeca Palas turbojets mounted one above the other at the rear of the fuselage. The vertical tail surfaces are mounted at the ends of twin booms, with the Vee tailplane in between the fins and supported at its centre by a dorsal fin on the aft end of the fuselage. Separate air inlets are provided for the two engines; in the wing roots for the lower engine and on the side of the rear fuselage for the upper engine. The landing-gear is a retractable tricycle. No other details are available.

Dimensions (Approx.).—
Span 5.25 m. (17 ft. 2 in.).
Length 5.9 m. (19 ft. 4 in.).

Loaded Weight (Approx.).—
1,060 kg. (2,340 lb.).

Performance.—
Max. speed 750 km.h. (466 m.p.h.).

THE TYPE 522.

Type.—Two-seat Advanced Trainer developed from the Type 213.

Designers.—Engineers Sostaric and Dabinović.

Wings.—Low-wing cantilever monoplane. All-metal construction.

Fuselage.—Oval section all-metal structure.

Tail Unit.—Cantilever monoplane type.

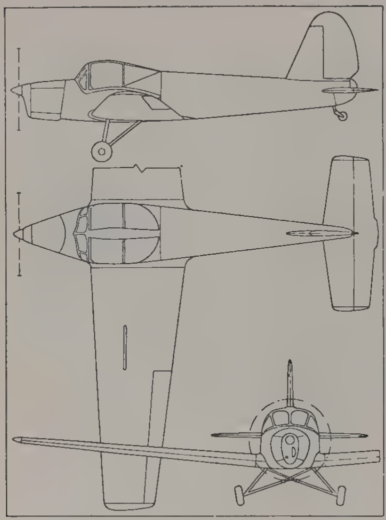
Landing Gear.—Tail-wheel type. Main wheels retract forward into fairings at the wing roots. Non-retracting tail-wheel.

Power Plant.—One 600 h.p. Pratt & Whitney R-1340 Wasp nine-cylinder radial air-cooled engine.

Accommodation.—Tandem seats under a continuous canopy with sliding sections over each cockpit.

Dimensions, Weights and Performances.—No data available.

The Type 452-M (two Turbomeca Palas turbojet engines).



The C-3 Trojka.

THE S-49C.

Designers.—Engineers Sivcev, Zrnic, and Popovic.

Type.—Single-seat Fighter.
Wings.—Low-wing cantilever monoplane. Two-spar all-metal structure.
Fuselage.—Welded steel tube structure.
Tail Unit.—Cantilever monoplane type.
Landing Gear.—Retractable tail-wheel type. Main wheels retract inwardly into wings, tail-wheel backward into fuselage.
Power Plant.—One 1,500 h.p. Hispano-Suiza 12Z twelve-cylinder vee liquid-cooled engine driving a three-blade airscrew. Radiator under fuselage aft of wings.
Accommodation.—Enclosed cockpit with sliding canopy. Bullet-proof windscreen and armour plate protection.
Armament.—Two 12.7 mm. machine-guns in top cowling and one 20 mm. cannon firing through the airscrew hub.
Dimensions (Approx.).—
Span 9.45 m. (31 ft.).
Length 8.5 m. (28 ft.).
Height 2.9 m. (9 ft. 6 in.).
Weight Loaded (Approx.).—
(7,500 lb.).
Performance.—
Max. speed 640 km.h. (400 m.p.h.) at 1,525 m. (5,000 ft.).

THE TYPE 214.

Designer.—Eng. Prof. Sima Milutinovic

Type.—Twin-engined Bombing and Aircrew Trainer.
Wings.—Low-wing cantilever monoplane. Dihedral outboard of engine nacelles.
Fuselage.—Oval section structure.
Tail Unit.—Braced monoplane type with twin fins and rudders.
Landing Gear.—Retractable type. Main wheels retract backwards into engine nacelles, leaving part of wheels projecting. Fixed tail-wheel.
Power Plant.—600 h.p. Pratt & Whitney R-1340 nine-cylinder radial air-cooled engines.
Accommodation.—Enclosed cockpit seating two side-by-side over leading-edge of wings. Bomb-aimer's position in nose with observation windows and optically flat aiming panel. Cabin aft of pilot's compartment for navigator, radio-operator or 6-8 pupils.
Dimensions, Weights and Performance.—No data available.

THE TYPE 215.

Designer.—Eng. Dusan Stankov.

Type.—Twin-engined Communications and Training monoplane.
Wings.—Low-wing cantilever monoplane. Dihedral from roots. Flaps fitted.
Fuselage.—Oval section structure with solid nose.
Tail Unit.—Braced monoplane type with twin fins and rudders.
Landing Gear.—Retractable type. Main wheels retract backwards into engine nacelles. Fixed tail-wheel.
Power Plant.—Two 480 h.p. Ranger SGV-770 twelve-cylinder inverted vee air-cooled engines driving two-blade airscrews.
Accommodation.—Enclosed cockpit seating two side-by-side with dual controls. Observer facing aft in cabin under transparent fairing.
Dimensions, Weights and Performance.—No data available.

THE C-3 TROJKA (THREE).

Designers.—Engineers Boris Cijan and Petrovic.

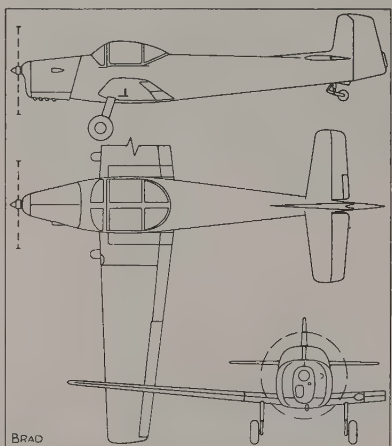
Type.—Two-seat Light monoplane.
Wings.—Low-wing cantilever monoplane. Single-spar all-wood structure. Detachable wing-tips. Spoiler-type slatted air-brakes on top surfaces hinge downward into slots aft of main spar when not in use. Wing area 15.5 m.^{2} (166.8 sq. ft.).
Fuselage.—All-wood structure in two main portions with joint aft of cabin. Rear fuselage a pure monocoque.
Tail Unit.—Cantilever monoplane type. All-wood structure. Single-piece tailplane and elevator. Detachable fin and horn-balanced rudder. Trim-tab in centre of elevator.
Landing Gear.—Split type. Two hinged side vees and two half axles with rubber cord springing at inner ends of axles. Swivelling tail-wheel.
Power Plant.—One 60 h.p. Walter Mikron II four-cylinder in-line inverted air-cooled engine on steel-tube mounting. Two-blade fixed-pitch airscrew. Fuel tank aft of seats. Oil tank in engine compartment.
Accommodation.—Enclosed cabin seating two side-by-side with dual controls. Cabin top is divided on fore-and-aft centre-line and each curved side section slides aft for access to both seats.
Dimensions.—
Span 10.5 m. (34 ft. 5 in.).
Length 8.85 m. (29 ft.).
Height 2.10 m. (6 ft. 10 in.).
Weights and Loadings.—
Weight empty 374.7 kg. (824.3 lb.).
Weight loaded 603.7 kg. (1,328.1 lb.).
Wing loading 39.0 kg./m.^{2} (7.99 lb./sq. ft.).
Performance.—
Max. speed 161 km.h. (100 m.p.h.).
Cruising speed 145 km.h. (90 m.p.h.).
Min. speed 73.6 km.h. (45.7 m.p.h.).
Landing speed (with air-brakes) 65 km.h. (40.4 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 10.3 min.
Service ceiling 3,900 m. (12,790 ft.).
Range 590 km. (376 miles).
Take-off run 177 m. (174 yds.).
Landing run (with air-brakes) 215 m. (211 yds.).

THE KB-6 MATAJUR.

The KB-6 Matajur was designed by the Letalski Konstrukcijski biro, a design group of the High Technical School in Ljubljana. Responsible for the design and its subsequent development are Dusan Cener, Stane Grcar, Natan Bernot and Vital Kovacic.

Type.—Two-seat Trainer and Tourer.
Wings.—Low-wing cantilever monoplane. Aspect ratio 8. Taper ratio 0.5. Dihedral 5° 50′. Wood structure with one main spar. Plywood covering over leading-edge, fabric over remainder. Auxiliary spar carries flaps and statically and aerodynamically balanced ailerons. Flap area 1.42 m.^{2} (15.3 sq. ft.). Total aileron area 1.38 m.^{2} (14.8 sq. ft.). Gross wing area 14.0 m.^{2} (150.7 sq. ft.).

The KB-6 Matajur (136 h.p. Régnier 4L00 engine).



The KB-6 Matajur.

Fuselage.—All-wood semi-monocoque structure.
Tail Unit.—Cantilever monoplane type. Fixed surfaces are all wood, aerodynamically balanced elevators and rudder have wood frames and fabric covering. Starboard elevator has trim-tab controllable from cockpit.
Landing Gear.—Fixed tail-wheel type. Spring-oil shock-absorbers. Steerable tail-wheel. Hydraulic wheel brakes. Track 2.5 m. (8 ft. 2 in.).
Power Plant.—One 136 h.p. Régnier 4L00 four-cylinder in-line inverted air-cooled engine on steel-tube bearers. Two-blade fixed-pitch wood airscrew, 1.95 m. (6 ft. 5 in.) diameter. Aluminium fuel tank (141 litres = 37.2 Imp. gallons) in fuselage behind seats. Oil tank 9 litres (2.4 Imp. gallons).
Accommodation.—Enclosed cabin seating two side-by-side with dual controls. Adjustable seats. Baggage compartment

The KB-6 Matajur (136 h.p. Régnier 4L00 engine).

The KB-6 Matajur-Trised (160 h.p. Walter Minor JW-6-III engine).

aft of seats. Full electrical equipment. Glider towing hook. Touring version has upholstered cabin.

DIMENSIONS.—
Span 10.6 m. (34 ft. 9 in.).
Length 8.36 m. (27 ft. 5 in.).
Height 2.15 m. (7 ft. 1 in.).

WEIGHTS AND LOADINGS.—
Weight empty 659 kg. (1,453 lb.).
Crew (2) with parachutes 180 kg. (397 lb.).
Fuel and oil 110 kg. (234 lb.).
Baggage 30 kg. (66 lb.).
Weight loaded 979 kg. (2,159 lb.).
Wing loading 70 kg./m.² (14.3 lb./sq. ft.).
Power loading 7.2 kg./h.p. (15.8 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 222 km.h. (138 m.p.h.).
Cruising speed 200 km.h. (124 m.p.h.).
Min. speed with flaps 88 km.h. (55 m.p.h.).
Initial rate of climb 215 m./min. (689 ft./min.).
Service ceiling 4,500 m. (14,800 ft.).
Range 820 km. (510 miles).

THE KB-6 MATAJUR-TRISED.

The Matajur-Trised is a three-seat version of the previously-described model. This version is powered by a 160 h.p. Yugoslav-built Walter Minor JW-6-III six-cylinder inverted air-cooled engine.

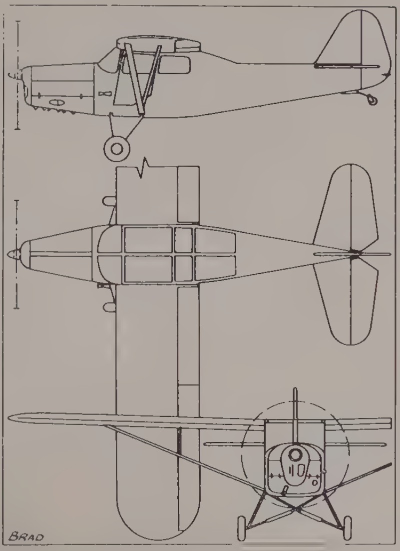
DIMENSIONS.—
Same as for KB-6 two-seater.

WEIGHTS AND LOADINGS.—
Weight empty 710 kg. (1,562 lb.).
Weight loaded 1,150 kg. (2,530 lb.).
Wing loading 82.2 kg./m.² (16.63 lb./sq. ft.).
Power loading 7.18 kg./h.p. (15.79 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 230 km.h. (143 m.p.h.).
Max. speed at 2,000 m. (6,560 ft.) 220 km.h. (137 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Min. speed with flaps 90 km.h. (56 m.p.h.).
Rate of climb at S/L. 150 m./min. (492 ft./min.).
Service ceiling 3,500 m. (10,480 ft.).
Range 650 km. (405 miles).
Take-off distance to clear 15 m. (50 ft.) 450 m. (492 yds.).

THE LK-1.

The LK-1 has been built in the Letov aircraft factory at Ljubljana. It was first conceived as a two-seater with a 100 h.p. engine but the design was changed during construction to its present form as a four-seater with a 160 h.p. engine. The prototype first flew on January 5, 1955.



The LK-I.

DESIGNER.—Prof. Dr. Eng. A. Kuhelj.

TYPE.—Four-seat Tourer, also suitable for use as an Ambulance, Glider-tug, Agricultural aircraft, etc.

WINGS.—High-wing strut-braced monoplane. NACA 2415 wing section. Two-spar wood structure covered with plywood and fabric. Flaps inboard of ailerons. Ailerons and flaps are of wood with fabric covering. Gross wing area 17.5 m.² (188 sq. ft.).

FUSELAGE.—Welded steel tube structure covered with fabric.

TAIL UNIT.—Braced monoplane type. Adjustable tailplane. Welded steel-tube framework covered with fabric.

LANDING GEAR.—Fixed split-axle type. Rubber-in-compression springing. Steerable tail-wheel.

POWER PLANT.—One 160 h.p. Yugoslav Walter JW-6-III six-cylinder in-line inverted air-cooled engine. Two-blade fixed-pitch wood airscrew. Two fuel tanks, one in each wing, with a total capacity 132 litres (29 Imp. gallons). Two reserve fuel tanks under front seats with a total capacity of 54 litres (12 Imp. gallons. Oil tank (15 litres = 3.3 Imp. gallons) behind fire wall.

ACCOMMODATION.—Enclosed cabin seating four in two pairs, front pair with dual controls. Two doors. One-piece moulded Plexiglas windshield.

DIMENSIONS.—
Span 11.30 m. (37 ft.).
Length 7.5 m. (24 ft. 7 in.).
Height (tail down) 2.20 m. (7 ft. 2½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 690 kg. (1,518 lb.).
Weight loaded 1,190 kg. (2,618 lb.).
Wing loading 68 kg./m.² (13.94 lb./sq. ft.).
Power loading 7.5 kg./h.p. (16.5 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 190 km.h. (119 m.p.h.).
Cruising speed at 1,000 m. (3,280 ft.) 150 km.h. (93 m.p.h.).
Rate of climb at S/L. 150 m./min. (492 ft./min.).
Service ceiling 2,600 m. (8,530 ft.).
Range in still air 500 km. (310 miles).


The LK-I Four-seat Cabin Monoplane (160 h.p. Walter Minor JW-6-III engine)

ADDENDA

TO THE AEROPLANE SECTION OF

JANE'S

ALL THE WORLD'S AIRCRAFT

1955-56

This Supplement contains photographs and information of aircraft which have become available for publication since the Aeroplane Section closed for press. In those cases where the photographs supplement descriptions and specifications already in the main section, page references are given in the descriptive titles under the illustrations.

September 30th, 1955

ADDENDA (GREAT BRITAIN)

AVRO

Two views of the Avro Shackleton M.R. Mk. 3, the first of which made its maiden flight on September 2, 1955. The new version differs externally from the Mk. 2 in having a nose-wheel landing-gear and wing-tip tanks. Further details and a three-view drawing of the Shackleton M.R. Mk. 3 will be found on page 54.

BRISTOL

BRISTOL AIRCRAFT, LTD.

Directors: C. F. Uwins, O.B.E., A.F.C., F.R.Ae.S. (Chairman); P. G. Masefield, M.A. (Eng.)., F.R.Ae.S., M.Inst.T., F.I.Ae.S. (Managing Director); Sir Reginald Verdon Smith, M.A., B.C.L., J.P.; Brian Davidson, M.A.; F. R. Banks, C.B., O.B.E., F.R.Ae.S., M.I.Mech.E., F.Inst.Pet.; Dr. A. E. Russell, C.B.E., D.Sc., F.R.Ae.S.; R. S. Brown, M.I.P.E.; W. R. Farnes, O.B.E.; H. J. Pollard, Wh.Ex., F.R.Ae.S.

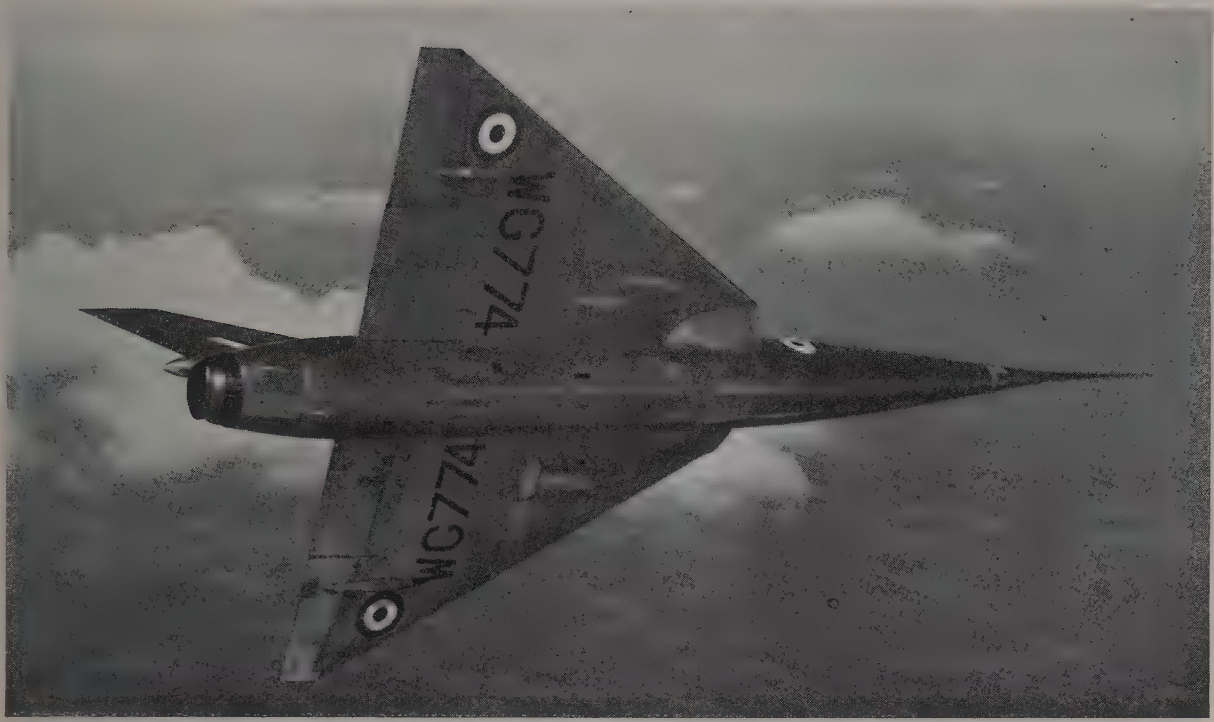
Since the closure for press of the main section of this book, the Bristol Aeroplane Co., Ltd. has announced that it has decided to transfer the operations of its Aircraft, Engine and Car Divisions to the control of three new subsidiary companies. A new company known as Bristol Aircraft, Ltd., will therefore take over the assets and liabilities of the Aircraft Division on January 1, 1956. The first directors of the new company are as in the previous column.

Similar details concerning the new company—Bristol Aero-Engines, Ltd.—which will take over the Engine Division on January 1, 1956, will be found in its appropriate place in the Aero-Engine Section of this book.

The caption to the illustration of the Bristol Type 173 helicopter at the top of page 62 is incorrect. The illustration shows the second prototype Type 173 with four-blade rotors. This particular aircraft, although fitted with rotors such as will be fitted to the Mk. 3, is still powered by two 550 h.p. Alvis Leonides engines, and not with 850 h.p. Leonides Major engines as is stated in the caption.

The Bristol Olympus-powered Canberra which, on August 29, 1955, set up a new World's Height Record of 65,876 ft. (20,092 m.). This same aircraft, with Olympus engines of an earlier mark, held the previous record of 63,668 ft. (19,418 m.) set up on May 4, 1953.

FAIREY



The first photograph to be released which shows the plan-form of the Fairey F.D.3 high-speed research monoplane. Further details, another photograph and a 3-view drawing of the F.D.3 will be found on page 74.

THE FAIREY ULTRA LIGHT HELICOPTER.

The photograph alongside of the Fairey Ultra Light Helicopter shows the principal features of this small jet-driven rotary-wing aircraft. Fairey pressure-jet units at the rotor tips are fed with compressed air from a Blackburn-Turbomeca Palouste turbo-generator the location of which is clearly shown in the accompanying illustration. Further details of the Ultra Light helicopter will be found on page 77.

DIMENSIONS.—
Rotor diamater 28 ft. 3 in. (8.61 m.).
Length of fuselage 14 ft. (4.27 m.).
Length overall 14 ft. 8 in. (4.47 m.).
Height 7 ft. 11 in. (2.43 m.).
Width 6 ft. 3 in. (1.91 m.).

The Fairey Ultra Light Jet-driven Helicopter.

HANDLEY PAGE

The prototype Handley Page Herald (four 870 h.p. Alvis Leonides Major engines) just after completing its maiden flight on August 25, 1955.

HANDLEY PAGE—*continued*

Another view of the Handley Page Herald medium-range "branch" airliner. A description, specification and three-view drawing of the Herald appears on page 83.

WESTLAND

The Westland Widgeon Helicopter (550 h.p. Alvis Leonides engine). The Widgeon is a development of the Dragonfly. It has a new cabin section and rotor head. Further details will be found on page 106.

ALL THE WORLD'S AERO-ENGINES

(CORRECTED TO JULY 31st, 1955)

ARRANGED IN TWO PARTS:

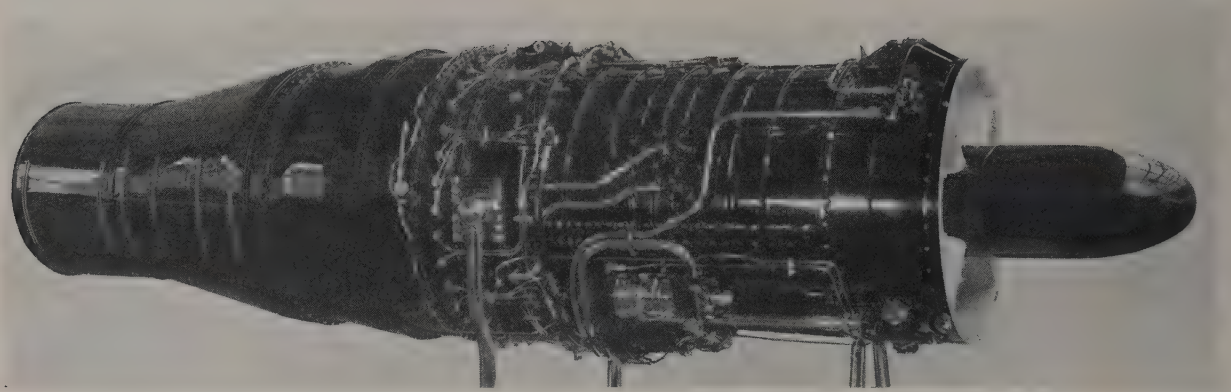
(1) GAS-TURBINE ENGINES
(2) PISTON ENGINES

PART I—GAS TURBINE ENGINES

THE BRITISH COMMONWEALTH

GREAT BRITAIN

ARMSTRONG SIDDELEY



The Armstrong Siddeley Sapphire ASSa6 turbojet engine (8,000 lb.=3,650 kg. s.t. at sea level).

ARMSTRONG SIDDELEY MOTORS LTD.

HEAD OFFICE AND WORKS : COVENTRY.

Directors : Sir Frank Spencer Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman), Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S., H. Burroughes, F.R.Ae.S., H. T. Chapman, C.B.E., F.R.Ae.S., M.I.Mech.E. (Managing Director), W. F. Saxton, M.B.E. (General Manager), M. N. Golovine, M.B.E., D.L., A.F.R.Ae.S. (Aero Sales), W. H. Lindsey, M.A., F.R.Ae.S. (Chief Engineer).

Prior to their entry into the gas turbine field Armstrong Siddeley Motors had done some of the early experimental work on axial-flow compressors and blade forms, as well as manufacturing the R.A.E. research contra-flow unit in 1939 to the designs of Dr. Griffiths.

Early in 1942 the design of the A.S.X. engine was prepared. This was a jet engine of high efficiency to give a sea level static thrust of 2,500 lb. (1,134 kg.) with a specific consumption of less than unity. The prototype unit was produced in 1943, having taken only nine months for design and manufacture.

During the development of the A.S.X. engine, design studies were made of alternative means for increasing the thrust with a view to applying the turbine engine to moderate speed aircraft and the decision was taken to develop a turboprop engine based on the A.S.X. This resulted in the Python airscrew-turbine engine which first ran and passed its acceptance test in 1945. The Python engine powers the Westland Wyvern S. Mk. 4 Strike aircraft which is now in service with the Royal Navy in 1953.

In 1945 it was decided to design a turboprop engine in the 1,000 h.p. class, and in April, 1946, the prototype engine, named the Mamba, ran for the first time. The Mamba passed its Type-Test in February, 1948. The latest version of the Mamba now in production, the ASMa.6, has a much greater output than the earlier versions.

The latest Armstrong Siddeley engine is the Sapphire which is in super-priority production for several of the latest aircraft ordered by the Royal Air Force.

Other important engines are the Double Mamba, which powers the Fairey Gannet, and the Viper, which was evolved as a "short-life" engine but has since been developed as a conventional long-life engine and in its latter form powers the Folland Midge and the Percival Jet Provost trainer.

In 1950 an agreement was concluded between Armstrong Siddeley Motors, Ltd. and the Curtiss-Wright Corporation whereby Curtiss-Wright acquired the right to build Armstrong Siddeley gas-turbine engines in the United States.

In 1953 a licence for the manufacture in France of the Viper long-life turbojet engine was acquired by Avions Marcel Dassault.

THE ARMSTRONG SIDDELEY SAPPHIRE.

The Sapphire engine is a turbojet with an axial-flow compressor and an annular combustion chamber of the Armstrong Siddeley vaporising type.

The ASSa.3 completed a 150-hour Service Type Test in November, 1951, at a sea level static maximum rating of 7,500 lb. (3,450 kg.) with a specific consumption of 0.91 lb./hr./lb. (0.91 kg./hr./kg.). In May, 1952, a later mark of Sapphire, the ASSa.6, passed the 150-hour Type Test at 8,300 lb. (3,770 kg.) s.t., as a result of which the engine was cleared for production at 8,000 lb. (3,632 kg.) thrust.

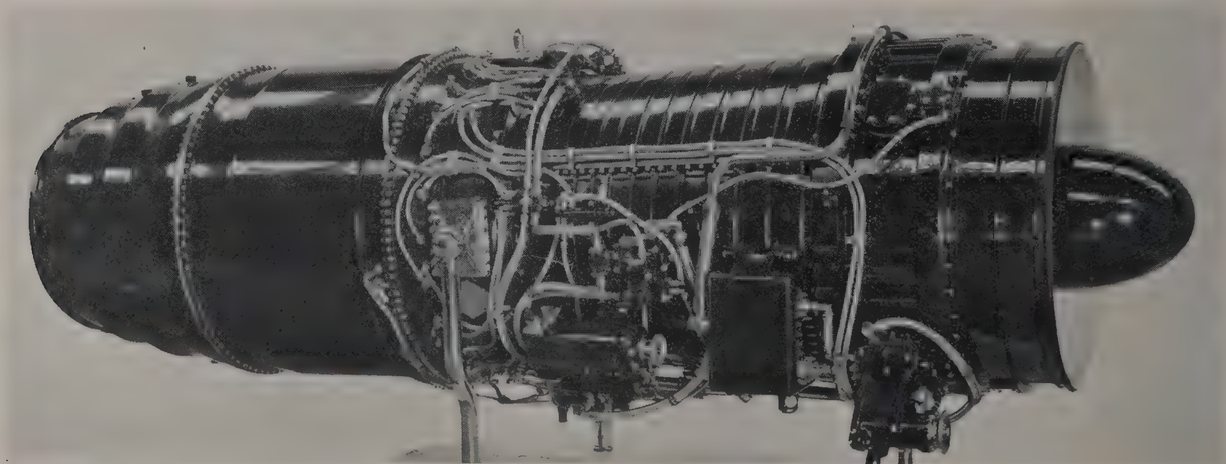
In September, 1954, the Sapphire ASSa.7 was successfully type-tested at 10,200 lb. (4,650 kg.) thrust with a specific fuel consumption of 0.885 lb./hr./lb. (0.885 kg./hr./kg.), thus becoming the first British turbojet engine to be type-tested at over 10,000 lb. (4,540 kg.) s.t.

Mention may also be made of three further versions in the Sapphire series, the ASSa.4, ASSa.5 and ASSa.9, but no details of these engines were available for publication at the time of writing.

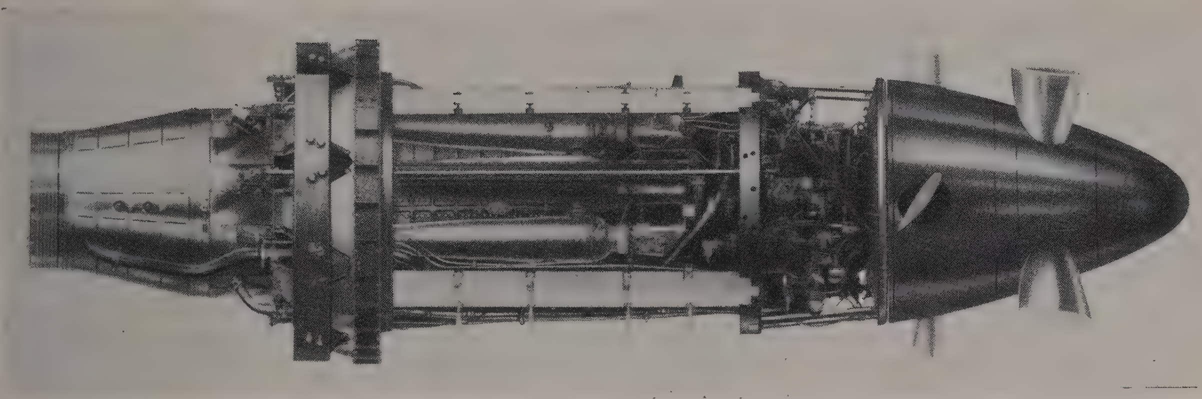
Particular attention has been given to matching the characteristics of the Sapphire compressor, turbine and control system to provide rapid surge free acceleration in all flight conditions.

Re-heat, or afterburning, is being developed for the Sapphire and flight testing continues in a specially converted Canberra flying test-bed.

The Sapphire powers the Gloster Javelin, the Hawker Hunter F. Mk. 2



The Armstrong Siddeley Sapphire ASSa.7 turbojet engine (10,200 lb.=4,535 kg. s.t. at sea level).



The Armstrong Siddeley Python turboprop engine which has a take-off output of 3,670 s.h.p. plus 1,180 lb. (535 kg.) jet thrust.

and 5, the Handley Page Victor and the English Electric P.1 the first British fighter capable of sustained level supersonic flight.

The Sapphire also powered the third prototype SNCASO Vautour and the Swiss P.16 fighter.

Mention may also be made of three further versions, the ASSa.4, ASSa.5 and ASSa.9, but no details were available for publication at the time of writing.

The Sapphire is in large-scale production in the United States, under the designation J65, by the Wright Aeronautical Corporation and the Buick Division of General Motors Corporation. The J65 powers the Republic F-84F and RF-84F, the Martin B-57A, B-57B and B-57C, the North American FJ-3 and FJ-4, the Lockheed F-104, the Grumman F11F-1 and the Douglas A4D.

Although a detailed description of the Sapphire is not permissible, the engine is generally similar to the American-built J65 version, a description of which will be found under "Wright" (U.S.A.) in this Section.

Dimensions (ASSa.6).—
Max. diameter excluding accessories 37.4 in. (95 cm.).
Length overall, including nose fairing and exhaust cone approx. 134 in. (340 cm.).
Internal jet pipe diameter (min.) 22.6 in. (57.4 cm.).

Dimensions (ASSa.7).—
Max. diameter same as ASSa.6.
Length overall, including nose fairing and exhaust cone 132 in. (339 cm.).
Internal jet pipe diameter (min.) 25.2 in. (64 cm.).

Net Dry Weight (ASSa.6).—
Including anti-icing protection, high-energy ignition units and oil tank 2,700 lb. (1,225 kg.).

Net Dry Weight (ASSa.7).—
Including anti-icing protection, high energy ignition units and oil tank 3,075 lb. (1,395 kg.).

Performance (ASSa.6).—
Static thrust at S/L. 8,000 lb. (3,650 kg.) at 8,600 r.p.m.

Performance (ASSa.7—initial rating).—
Static thrust at S/L. 10,200 lb. (4,535 kg.) at 8,600 r.p.m.

Fuel Consumption.—
At rated thrust 0.90 lb./hr./lb. (0.90 kg./hr./kg.) for ASSa.6, 0.885 lb./hr./lb. (0.885 kg./hr./kg.) for ASSa.7.
Cruising 0.85 lb./hr./lb. (0.85 kg./hr./kg.) for ASSa. 6.

THE ARMSTRONG SIDDELEY PYTHON 3.

Type.—Axial-flow Turboprop with 14-stage compressor, 11 combustion chambers and 2-stage turbine.

Propeller Drive.—Epicyclic spur reduction gear driven from front end of compressor, drives two contra-rotating co-axial propeller shafts. Standard gear ratio 0.135 : 1. SBAC Nos. 5½ and 7½ shafts. Torquemeter and propeller brake. Rotol eight-blade contra-rotating constant-speed feathering propeller.

Air Intake.—Annular intake surrounds engine amidships. Air enters through eleven radially disposed ducts between rear ends of combustion chambers into rear end of compressor.

Compressor.—Reverse-flow type with five low and nine high-pressure stages. Two forged aluminium-alloy drum type rotors joined between the 5th and 6th stages form the 14 stage axial flow compressor. Cast aluminium-alloy stator casing, split horizontally, has one row of inlet guide vanes and 13 rows of stator blades. All blades are of aluminium-alloy. Compression ratio 5.35 : 1. Mass air flow 52.5 lb. (23.8 kg.) per sec. at 8,000 r.p.m. at sea level.

Combustion Chambers.—Eleven tubular stainless steel combustion chambers each containing a concentrically-mounted flame tube of Nimonic 75 alloy. Armstrong Siddeley pre-vapourising system of combustion in which fuel from main jet is vapourised and partly mixed with air in mixing chamber before it enters the combustion space proper. Final mixing of combustion gases by deflectors just aft of flame tube exit.

Fuel System.—Distributor and 11 main leads to Armstrong Siddeley burner-vapouriser fed by Lucas variable-stroke multi-plunger pump with relief valve and overspeed governor. Armstrong Siddeley flow-control unit. Single-lever control with fuel and propeller controls interconnected.

Fuel Grade.—Standard Aviation Turbofuel.

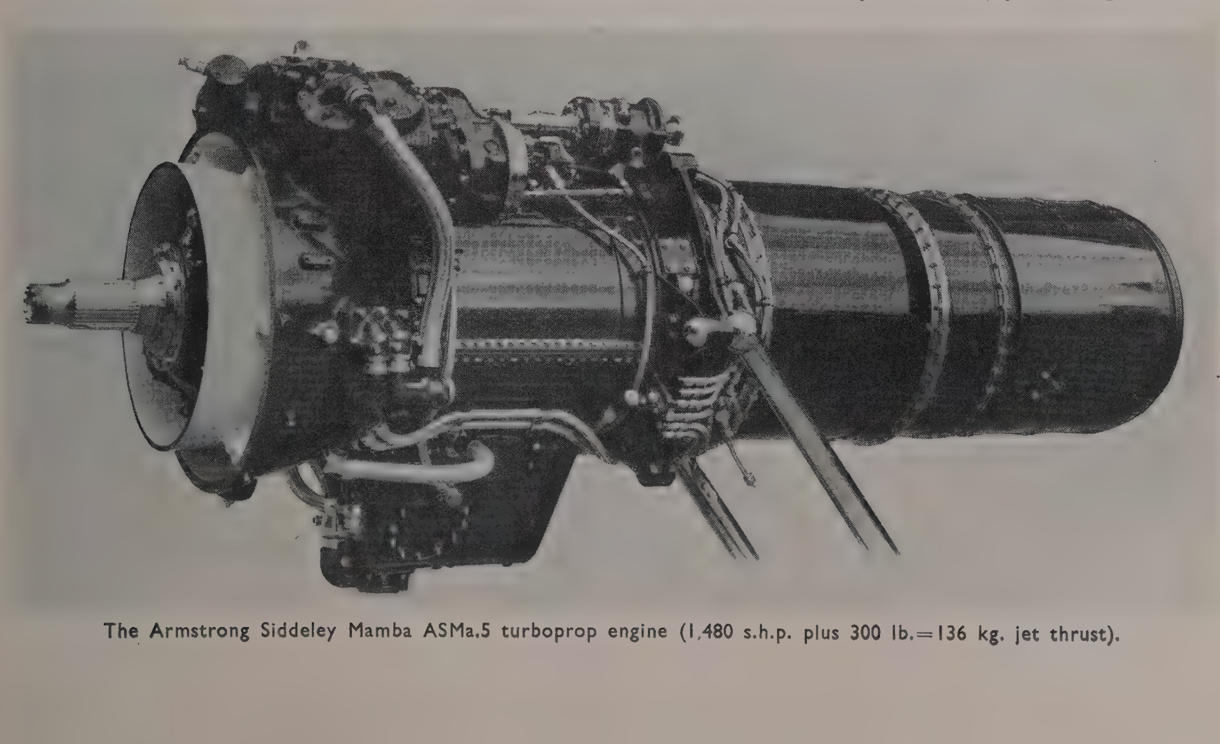
Nozzle Guide Vanes.—Turbine outer casing of stainless steel incorporating two rows of nozzle guide vanes of Nimonic 80 alloy, 82 blades in first row and 92 in second.

Turbine.—Two-stage turbine. Twin air-cooled disc of Hadfield HGT3 alloy carries two stages of blading, each stage consisting of 120 blades of Nimonic 80 alloy. Fir tree blade roots. Disc is on hollow shaft which runs on air cooled ball and roller bearings.

Jet Pipe.—Fixed inner cone and stainless steel sheet outer casing.

Accessory Drives.—Located round reduction gear casing behind propeller spinner. Additional 100 h.p. take-off at 0.336 engine speed for Rotol or similar accessory gearbox.

Lubrication System.—Main bearings pressure fed, turbine bearings fed by Tecalemit micropump, rest of lubrication by Armstrong Siddeley pumps. Main supply pressure 70 lb./sq. in. (4.9 kg./km.²).



The Armstrong Siddeley Mamba ASMa.5 turboprop engine (1,480 s.h.p. plus 300 lb.=136 kg. jet thrust).

Oil Specification.—D.Eng.R.D.2472.

Mounting.—Eleven brackets located at rear of intake casing. Pipes, controls, and cables brought to bulkhead adjacent to mounting brackets.

Starting.—B.T.H. QT.20 turbo, or Armstrong Siddeley air or cartridge-operated vane starter. Two Armstrong Siddeley igniter plugs energised by two B.T.H. high-tension coils.

Control System.—Single-lever pilot's control interconnected with airscrew and fuel controls.

Dimensions.—
Overall diameter 54.5 in. (1.384 mm.).
Length 122.7 in. (5.570 mm.).
Frontal area 16.2 sq. ft. (1.50 m.²).

Weight.—
3,450 lb. (1,565 kg.) + 2½%.

Performance Ratings.—
Take-off (static) 3,670 shaft h.p. plus 1,180 lb. (535 kg.) jet thrust (4,110 equivalent s.h.p.) at 8,000 r.p.m. at sea level.
Max. continuous (static) 2,900 shaft h.p. plus 1,050 lb. (476 kg.) jet thrust (3,303 equivalent s.h.p.) at 7,800 r.p.m. at sea level.

Consumptions.—
Fuel (cruising at 7,800 r.p.m. at 350 m.p.h. =560 km.h. at 20,000 ft.=6,100 m.) 0.80 lb. (0.36 kg.) per e.s.h.p./hr.
Oil 3.0 lb. (1.36 kg.) per hour.

THE ARMSTRONG SIDDELEY MAMBA.

The Mamba is a turboprop engine of the straight-through flow type, of which several versions are in existence. The description below refers generally to the ASMa.3 which was type-tested in 1951. Other versions include the ASMa.5 which develops a maximum power of 1,590 e.h.p. with a specific fuel consumption of 0.71 lb./hr./e.h.p. and has a dry weight of 820 lb. (372 kg.); the ASMa.6 which is the current version and of which no details were available at the time of writing; and the ASMa.7, which has been designed as a civil engine.

Type.—Axial-flow Turboprop with ten-stage compressor and two-stage turbine.

Propeller Drive.—Shaft driven through compound epicyclic helical and spur reduction gearing incorporating a torquemeter. Standard gear ratio 0.97 : 1. Shaft supported by one ball thrust bearing and a bronze bush at the rear end. Shaft size S.B.A.C. No. 4. Rotol or de Havilland four-blade constant-speed fully-feathering and braking propeller may be fitted.

Compressor.—Annular intake surrounding reduction-gear. Two-piece forged aluminium-alloy casing, split horizontally, with one row of entry guide vanes, ten rows of light-alloy stator blades and one row of outlet straightener blades dovetailed into circumferential slots. Ten rotor stages in aluminium except for the first three and last two stages which are in steel. The first three stages have solid discs and fir-tree blade roots, the remaining stages have blades rivetted between peripheries of opposed twin conical discs. Front and rear shafts supported in two-row ball and single-row roller bearings respectively. Reduction gear driven by sun-gear mounted on front shaft. Drives for engine and aircraft accessories taken off reduction gearing. Spherical coupling connects rear shaft through hollow extension shaft to turbine rotor. Compression ratio 5.35 : 1. Mass air flow at 15,000 r.p.m. at sea level 17.6 lb. (8.0 kg.) per sec.

Combustion Chambers.—Six interconnected straight-through flow vaporising-type chambers with stainless steel outer casings and Nimonic alloy flame tubes. Each flame tube has four fuel metering jets at front end feeding into four J-shaped primary air tubes which vaporise fuel and lead mixture upstream into air flow.

Fuel System.—One Lucas A variable-stroke multi-plunger with relief valve and over-speed governor. Lucas CCU combined fuel flow control unit, filter and isolator. Armstrong Siddeley slotted-piston fuel distributor with six main fuel outlets. Armstrong Siddeley burner-vaporisers.

Fuel.—Standard Aviation Turbofuel.

Turbine.—Two-stage turbine. Cast stainless steel manifold with 72 first-row and 95 second-row nozzle blades of Nimonic 80 alloy. Twin rotor discs of Jessop G.18B alloy, joined by Hirth coupling, air-cooled. Discs mounted on hollow stub shaft by clamping bolt. Rotor bearing of single roller type, air-cooled.

Tail Pipe.—Fixed area type. Steel casing and fixed inner cone.

Lubrication.—Main bearing pressure-fed. Turbine bearing fed by Tecalemit PE.7710 micropump, Armstrong Siddeley pumps for the rest of the oil system, reduction gear and torquemeter. Main oil supply at 70 lb./sq. in. (5 kg./cm.²). Gauze filter.

Oil.—D.Eng.R.D.2479 plus additive.

Starting.—24-volt Rotax EXP.4112 electric starter, or Armstrong Siddeley air/cartridge-operated vane starter or B.T.H. QT.19 cordite turbo starter. Two Armstrong Siddeley torch igniters, four Kigass atomisers and two B.T.H. C2TS or C7TS high-tension coils.

Dimensions.—
Diameter 29 in. (737 mm.).
Length 80 in. (2,032 mm.).
Frontal area 4.6 sq. ft. (0.43 m.²).

Net Dry Weight.—
800 lb. (362 kg.+2½%).

Ratings.—
Take-off (static) 1,320 shaft h.p. plus 405 lb. (184 kg.) jet thrust (1,475 equivalent s.h.p.) at 15,000 r.p.m. at sea level.
Max. continuous (static) 1,050 shaft h.p. plus 355 lb. (161 kg jet thrust (1,185 equivalent s.h.p.) at 15,000 r.p.m. at sea level.

Consumptions.—
Fuel (cruising at 14,500 r.p.m. at 350 m.p.h.=560 km.h. at 20,000 ft.=6,100 m.) 0.67 lb. (0.304 kg.) per e.s.h.p./hr.
Oil (cruise) 2 lb. (0.9 kg.) per hr.

THE ARMSTRONG SIDDELEY DOUBLE MAMBA.

The Double Mamba consists basically of two Mamba engines placed side-by-side and driving two contra-rotating co-axial airscrews. Although the two engines are joined together at the front end and use the same air intake and airscrew-shaft gear casing, they are otherwise two quite separate power-units. Each has its own fuel, lubrication and control systems, its own reduction-gear, and each drives one of the two co-axial airscrews. Each engine can be stopped, started, cruised or feathered under conditions entirely separate from the other. The Double Mamba is capable of running on Aviation turbofuel, "wide-cut" turbine fuel, Admiralty Diesel Oil (47 Cetane No.), or any mixture of these three fuels.

The Double Mamba powers the Fairey Gannet A.S. Mk. 1 Anti-Submarine monoplane, now being delivered to and entering service with the Royal Navy.

The two engines are standard Mambas and the description which follows is only concerned with the components which are peculiar to the Double Mamba.

The description below refers to the ASMD.1 (Mk. 100), which is made up of two ASMa.3 units. Two other versions may be mentioned, the ASMD.3 (giving 3,120 e.h.p.) and ASMD.4, which use, respectively, two Mamba ASMa.5 and ASMa.6 units.

Type.—Dual Turboprop made up of two Mamba engines, each driving independently one of two co-axial propeller shafts.

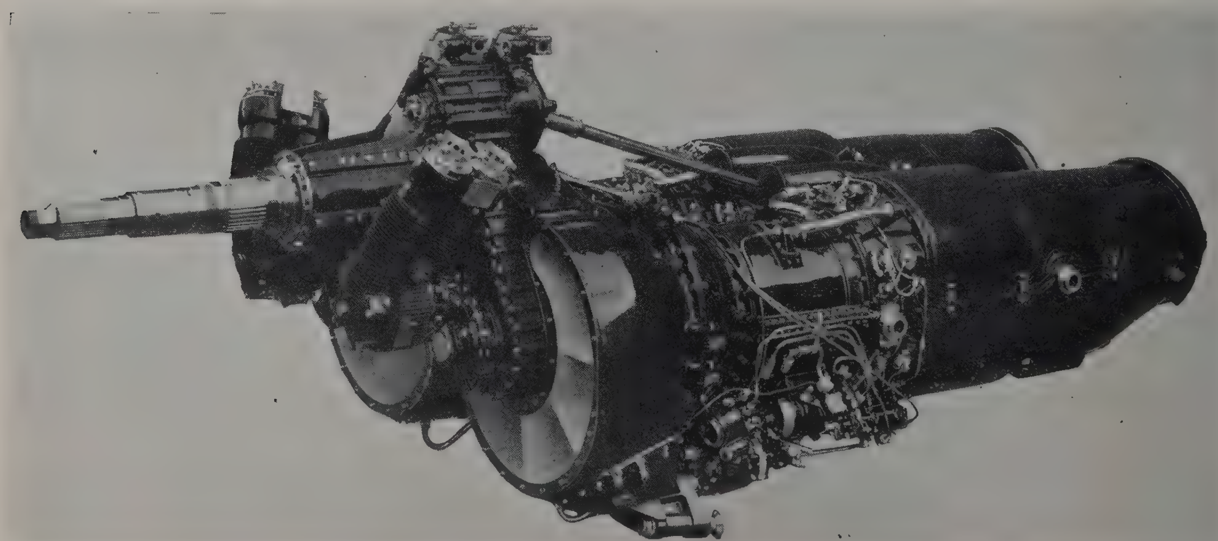
Compressors, Combustion Chambers, Turbines.—As for Mamba. Annular combustion chamber on ASMD3.

Front Casing.—Two Mamba engines without their individual reduction gears mounted on front casing which houses helical and spur reduction gears and drives for engine auxiliaries and aircraft accessory gear box. Each airscrew shaft has its separate train of gears and a roller clutch to prevent rotation during flight when either propeller is feathered. A free-wheel arrangement enables either unit to drive the aircraft accessories drive-shaft. Casing consists of three main magnesium castings containing the reduction gearing and air passages from kidney-shaped air entries to an annulus before the compressors. Three mounting points on casing. Either engine unit can be removed without disturbing rest of the assembly.

Airscrew Drive.—Two co-axial independent airscrew shafts, sizes S.B.A.C. No. 4 (front) and No. 6 (rear). Standard reduction ratio 0.0965 : 1 (10.36 : 1). Torquemeters and propeller brakes are incorporated. Shafts, whose centre-lines are 11 in. (27.9 cm.) above those of the two engine units, supported by ball and roller bearings. Provision for Rotol eight-blade constant-speed feathering and braking airscrew.

Fuel System.—Each engine component has its individual system as for Mamba.

Accessory Drives.—Gearbox mounted above air intake casing and driven by shaft which



The Armstrong Siddeley Double Mamba ASMD.1 turboprop engine (2,640 s.h.p. plus 810 lb.=368 kg. jet thrust).

is geared to both airscrew shafts, an idler being inserted to obtain correct direction of rotation. Free-wheel assembly provided to avoid connected drive between two components. Drive can transmit up to 100 h.p. at maximum r.p.m. and full power is available when either engine is feathered.

LUBRICATION.—Separate system for each half as for Mamba ASMa.3. Each gear train in reduction gear is lubricated with oil from driving engine.

OIL.—D.Eng.R.D.2479 plus additive.

STARTING.—Two 24-volt Rotax 4112 electric, or two Rotax cordite turbo starters, one for each component, mounted on front of reduction-gear casing. Two ASM torch igniters, four Kigass atomisers and two B.T.H. C2TS or C7TS ignition coils per component.

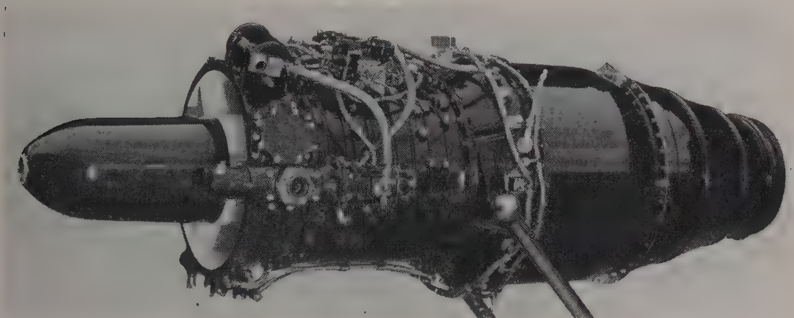
ENGINE CONTROLS.—Each engine component has its individual system as for Mamba.

DIMENSIONS.—
- Width 52.8 in. (1,341 mm.).
- Length 102 in. (2,590 mm.).
- Height 43.85 in. (1,111 mm.).

WEIGHT.—
- 2,150 lb. (970 kg.) + 2½%.

RATINGS (ASMD.1—Mk. 100).—
- Take-off (static) 2,640 shaft h.p. plus 810 lb. (368 kg.) jet thrust (2,950 equivalent s.h.p.) at 15,000 r.p.m. at sea level.
- Max. continuous (static) 2,100 shaft h.p. plus 710 lb. (277 kg.) jet thrust (2,373 equivalent s.h.p.) at 15,000 r.p.m. at sea level.

RATINGS (ASMD.3).—
- Take-off (static) 2,960 shaft h.p. plus 595 lb. (270 kg.) jet thrust (3,190 equivalent s.h.p.).



The Armstrong Siddeley Viper ASV.5 "long-life" turbojet engine.

CONSUMPTIONS (ASMD.1—Mk. 100).—
- Fuel (cruising at 15,000 r.p.m. at 350 m.p.h.=560 km.h. at 20,000 ft.=6,100 m.) 0.67 lb. (0.30 kg.) per e.s.h.p./hr.
- Oil (cruise) 4 lb. (1.8 kg.) per hr.

CONSUMPTIONS (ASMD.3).—
- Fuel 0.71 lb. (0.32 kg.) per e.s.h.p./hr.

THE ARMSTRONG SIDDELEY "SHORT-LIFE" VIPER.

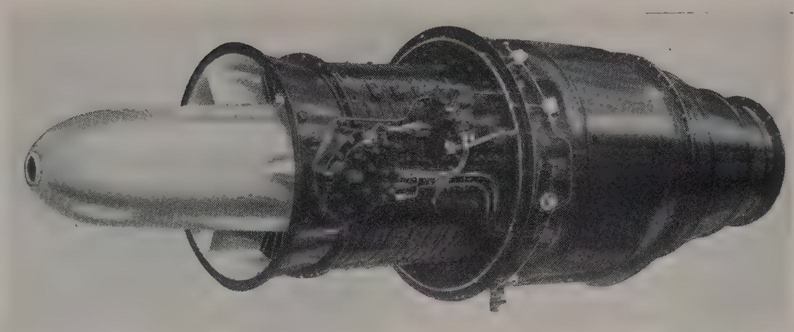
The Viper turbojet was originally designed for "short-life" full-throttle operation in expendible aircraft such as the Australian Jindivik pilotless target aircraft, for which the Viper ASV.3 (1,640 lb.=745 kg. s.t.) is in production.

The Viper has a seven-stage axial-flow compressor, an annular combustion chamber and a single-stage turbine.

In order to reduce cost the engine has been simplified as far as practicable and, consistent with its short but active life, only the most economical low grade materials are used in its construction.

The number of accessories has been reduced to two assemblies for the ASV.3, a combined fuel and oil pump assembly and a fuel flow control. The "long-life" engine, described later, has a conventional fuel system with the normal complement of accessories.

The Viper ASV.3 has been type-tested and is in production at 1,640 lb. (745 kg.) s.t. Development to higher performance is proceeding and already the ASV.4 of 1,750 lb. (795 kg.) and the ASV.6 of 1,900 lb. (860 kg.) thrust have been announced.



The Armstrong Siddeley Viper ASV.3 "short life" turbojet engine.

DIMENSIONS.—
- Diameter 23.25 in. (59 cm.).
- Overall length 82.7 in. (210 cm.).

NET DRY WEIGHT.—
- 365 lb. (166 kg.).

RATING.—
- Take-off static 1,640 lb. (745 kg.).

THE ARMSTRONG SIDDELEY "LONG-LIFE" VIPER.

The "long-life" Viper powers the Folland Midge, prototype of the Gnat light fighter, and the Percival P.84 Jet Trainer. This engine retains much of the desirable simplicity of the "short-life" engine, but has been modified in various respects in order to give an overhaul life equal to that of any other conventional aero-engine.

Apart from the ASV.5 which powers the two above-mentioned aircraft, mention may be made of the ASV.7R which develops a thrust of 2,470 lb. (1,120 kg.) with re-heat, and the ASV.10 which has a static thrust rating of 2,300 lb. (1,045 kg.).

A licence for the production of this engine in France has been acquired by Avions Marcel Dassault by whom it is called the M.D.30 Viper.

The M.D.30 Viper is currently flying in the SNCASO 9000 Trident jet and rocket-powered research monoplane, a Viper engine being mounted at each wing-tip. The Trident with rocket power on has exceeded Mach. 1 in a climb.

Another French aircraft designed to the same formula is the Dassault M.D.550 which is also powered by two M.D.30 Vipers and a liquid-fuel rocket motor.

DIMENSIONS.—
- Diameter 28 in. (71 cm.).
- Length (less generator fairing) 65.4 in. (166 cm.).

NET DRY WEIGHT.—
- 465 lb. (211 kg.).

RATING.—
- Take-off static 1,640 lb. (745 kg.).

CONSUMPTION.—
- Specific fuel consumption 1.09 lb./lb. s.t./hr. (1.09 kg./kg. s.t./hr.).

THE ARMSTRONG SIDDELEY SNARLER.

The Snarler is a liquid fuel rocket motor which is intended primarily to assist the manoeuvrability of fighter aircraft at very high altitudes where the thrust of jet engines has fallen off to such an extent that little or no margin of power is available for manoeuvring. It can also be used as a climb assister during the later stages of a climb.

The Snarler motor consists basically of a combustion chamber, pumps which deliver the propellants under pressure to the combustion chamber and tanks for liquid oxygen and methanol/water. In addition, there are certain small safety and control devices which are necessary for the satisfactory operation of the motor.

The motor is controlled by two switches in the pilot's cockpit, a master switch which starts or stops the rocket and a two-position "throttle" switch which selects either part or full thrust.

Work on the Snarler began in the autumn of 1947. A special category flight clearance test was completed in May, 1950, and the motor was flight tested for the first time on November 20, 1950, in a Hawker P.1072, a modified Sea Hawk prototype.

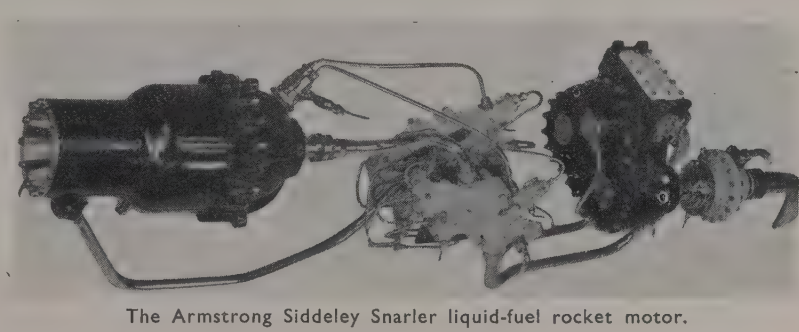
DIMENSIONS.—
- Diameter of combustion chamber 12.5 in. (31.8 cm.).
- Length of combustion chamber 23.4 in. (59.5 cm.).

WEIGHT.—
- Including all accessories 215 lb. (98 kg.).

PERFORMANCE.—
- Sea level thrust 2,000 lb. (910 kg.).
- The unit will continue to run so long as the fuels are supplied.

THE ARMSTRONG SIDDELEY SCREAMER.

The Screamer is a liquid-propellant rocket motor which has been designed for use in piloted aircraft. It can be used in conjunction with an ordinary jet turbine



The Armstrong Siddeley Snarler liquid-fuel rocket motor.

or, since it is a prime mover, it can be used independently. Practically, it will be used as a take-over source of power from the jet turbine when additional climb, height and speed are needed in combat.

The Screamer has been running on the test-bed for some time and at the time of writing had been installed in a Meteor for flying tests.

No further details of this rocket motor are available for publication.

BLACKBURN-TURBOMECA

BLACKBURN & GENERAL AIRCRAFT, LTD.

HEAD OFFICE AND WORKS, ENGINE DIVISION: BROUGH, E. YORKS.

LONDON OFFICE: 43, BERKELEY SQUARE, W.1.

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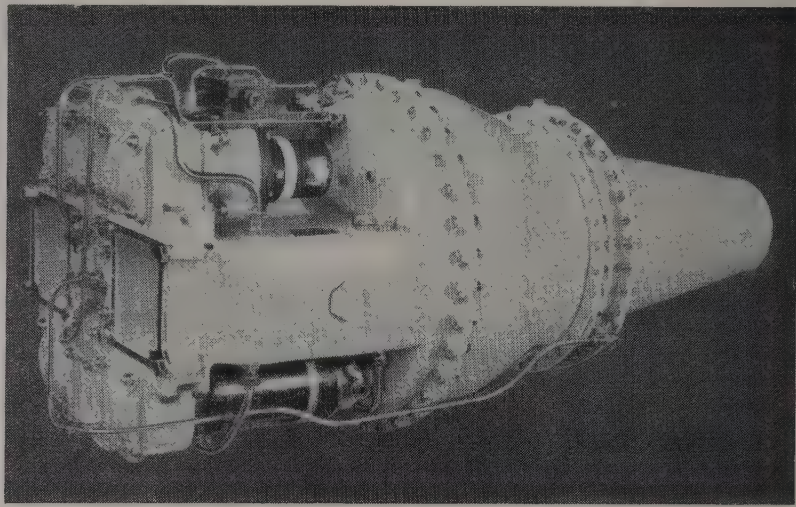
Blackburn & General Aircraft, Ltd. hold the exclusive manufacturing and selling rights in the United Kingdom and most of the British Commonwealth for the French-designed Turbomeca gas-turbine engines.

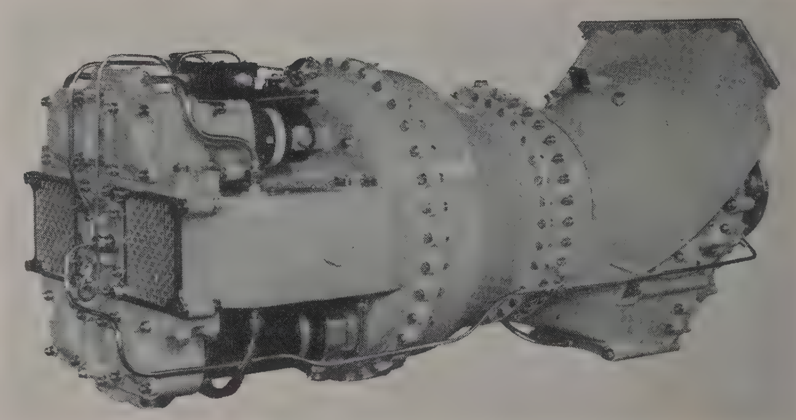
Blackburn has redesigned the first group of engines on which it is at present concentrating, various modifications having been embodied in order to meet British requirements and to simplify production. The Blackburn Turbomeca engines will be known as the 500 and 600 Series, the 500 Series engines having their mass flow reduced to approximately two-thirds of that of the 600 Series.

The 500/600 Series engines, which have a maximum number of interchangeable parts, can be divided into three main categories, namely pure jet engines (Palas), shaft turbines (Artouste and Turmo) and air compressors (Palouste). The Palas, which is the basic engine in the range, is suitable for installation in small pure jet aircraft, such as trainers and target aircraft. The other units have a variety of uses, the most obvious being as helicopter power-units.

Full details of the French Turbomeca range of gas-turbine engines will be found under "Turbomeca" (France).



The Blackburn-Turbomeca Palas turbojet engine.



The Blackburn-Turbomeca Artouste shaft turbine.

THE BLACKBURN-TURBOMECA PALAS.

The Palas is a small turbojet engine with a single-stage centrifugal compressor, an annular combustion chamber with a rotary fuel injector and a single-stage turbine.

The fuel system comprises a Plessey gear-type pump fitted to a Lucas control system which supplies fuel to the rotary injector, from which it is vented by centrifugal force.

A centrifugal governor is arranged to control both the idling and the higher engine speeds, while at low thrust settings the hand throttle controls the speed. A single-lever throttle control effects all these operations.

A torch igniter of Blackburn design, supplied with fuel from the main engine pump and using a high-energy spark unit or a booster coil, is employed to ignite the fuel on starting.

The oil system consists of a pressure-type oil pump feeding the bearings, together with two scavenge pumps. The oil tanks are cast integral with the intakes.

The nose casting, with bifurcated air intakes, which is common to all engines in the Blackburn-Turbomeca range, has been completely re-designed to enable all auxiliaries to be mounted within the diameter of the engine. Eight standard flanges are provided for normal auxiliaries and four for fuel and oil pumps. The flanges are interchangeable so that they can be arranged in any position, and all are readily accessible.

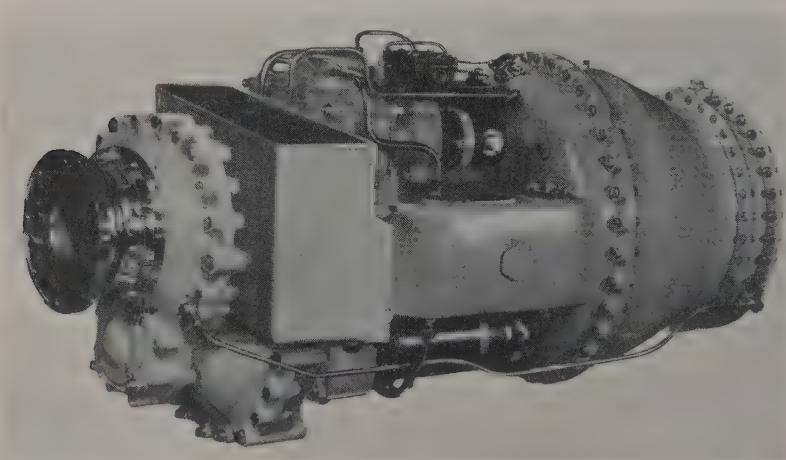
The following particulars relate to the Palas 600 Series engine:—

DIMENSIONS.—
Overall length 25.32 in. (64 cm.).
Max. diameter 17.10 in. (43 cm.).

NET DRY WEIGHT.—
148 lb. (67 kg.).

PERFORMANCE RATINGS.—
Take-off (static) 390 lb. (177 kg.).
Max. continuous 338 lb. (133 kg.).

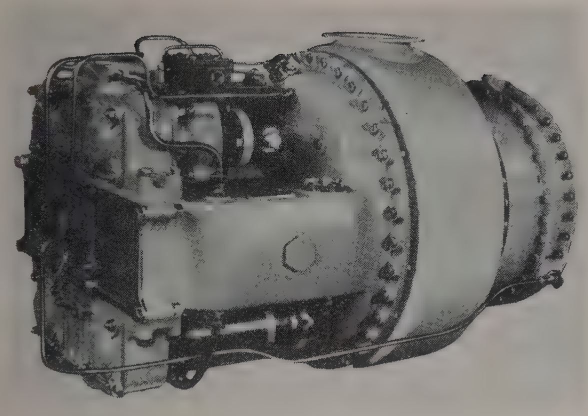
FUEL CONSUMPTION.—
Take-off 1.20 lb./lb. s.t./hr. (1.20 kg./kg. s.t./hr.).
Max. continuous 1.14 lb./lb. s.t./hr. (1.14 kg./kg. s.t./hr.).



The Blackburn-Turbomeca Turmo shaft turbine.

THE BLACKBURN-TURBOMECA TURMO.

The Turmo is a shaft turbine in which the exhaust gases of a Palas unit minus



The Blackburn-Turbomeca Palouste air generator.

jet pipe drive a free wheel turbine which, in turn, drives an output shaft at the rear of the engine through a reduction gear.

DIMENSIONS.—
Length overall 46.12 in. (117 cm.).
Width overall 17.10 in. (43 cm.).
Height overall 21.0 in. (53 cm.).

NET DRY WEIGHT.—
281 lb. (127.5 kg.).

POWER RATINGS (Turmo 500).—
Air mass flow 4.70 lb./sec. (2.13 kg./sec.).
Max. power output 335 h.p.
Max. continuous output 295 h.p.

POWER RATINGS (Turmo 600).—
Air Mass flow 7.19 lb./sec. (3.26 kg./sec.).
Max. power output 450 h.p.
Max. continuous output 400 h.p.

THE BLACKBURN-TURBOMECA ARTOUSTE.

The Artouste is a shaft turbine in which the power output shaft is directly coupled to the compressor of a Palas power unit. In this unit, however, a two-stage turbine is used, part of the power from which drives the compressor, the remaining power being available to drive the power take-off shaft through a reduction gear on the front of the engine.

DIMENSIONS.—
Length overall 40.0 in. (102 cm.).
Width overall 19.25 in. (49 cm.).
Height overall 18.55 in. (47 cm.).

NET DRY WEIGHT.—
278 lb. (126.2 kg.).

POWER RATINGS (Artouste 500).—
Air mass flow 4.70 lb./sec. (2.13 kg./sec.).
Max. power output 345 h.p.
Max. continuous output 300 h.p.

POWER RATINGS (Artouste 600).—
Air mass flow 7.19 lb./sec. (3.26 kg./sec.).
Max. power output 475 h.p.
Max. continuous output 415 h.p.

THE BLACKBURN-TURBOMECA PALOUSTE.

The Palouste is an air generator which, as its name implies, is made up of components of the Palas and Artouste. An oversize compressor delivers to the combustion chamber a greater quantity of air than the two-stage turbine can utilise. The combustion chamber has a double wall, the inner wall being perforated to permit the surplus compressed air to be bled off. An air delivery flange is located on top of the combustion chamber casing.

The Palouste has a maximum free air output of 2.725 lb./sec. (1.24 kg./sec.) at 41.55 lb./sq. in. (2.92 kg./cm.^{2}).

DIMENSIONS.—
Overall length 28.62 in. (73 cm.).
Max. diameter 18.50 in. (47 cm.).

NET DRY WEIGHT.—
178 lb. (80.8 kg.).

BRISTOL

BRISTOL AERO-ENGINES, LTD.

HEAD OFFICE, WORKS AND AERODROME: FILTON, NR. BRISTOL.

LONDON OFFICE: 6, ARLINGTON STREET, ST. JAMES'S, LONDON, S.W.1.

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With the progressive growth of the company's aviation activities at home and abroad, the Bristol Aeroplane Co., Ltd. decided late in 1955 to transfer the activities of its individual divisions to the control of separate subsidiary companies. As part of this reorganisation a new company known as Bristol Aero-Engines, Ltd. has been incorporated. It was due to take over the assets and liabilities of the Aero-Engine Division on January 1, 1956.

Through times of rapid technical change, the Bristol company has adhered to its traditional policy by providing engines of the highest thermal efficiency. With their Theseus engine, the first turboprop engine to pass the Ministry of Supply Type Test, they accumulated much experience ranging from test-bed development to service with R.A.F. Transport Command.

The first Proteus ran in 1947 and was followed two years later by the coupled Proteus. Continuous development produced the Proteus 600 (single) and 610 (coupled) engines in the Princess flying-boat, and the Proteus 625 engines flew in the prototype Britannia airliner.

The Proteus engine has now been completely redesigned and reappears as the 700 Series. These engines are notably more powerful than their predecessors, and are at the same time shorter and lighter.

Conservative assumptions were made in the design of the 700 Series engine and its rated performance as originally estimated has been considerably exceeded on test. These ratings, however, remain in force for the 700 Series because the mechanical design of the engine was based upon them. The company has, however, taken advantage of the potential performance of the engine and has now announced the Proteus 750 Series, the first major mechanical development of the 700 Series.

In the field of power-units for civil aircraft the Company is also engaged on development of the BE.25 supercharged turboprop engine. It is a constant-power engine and so is not subject to diminution of power with gain in height or when operating at high climatic temperatures.

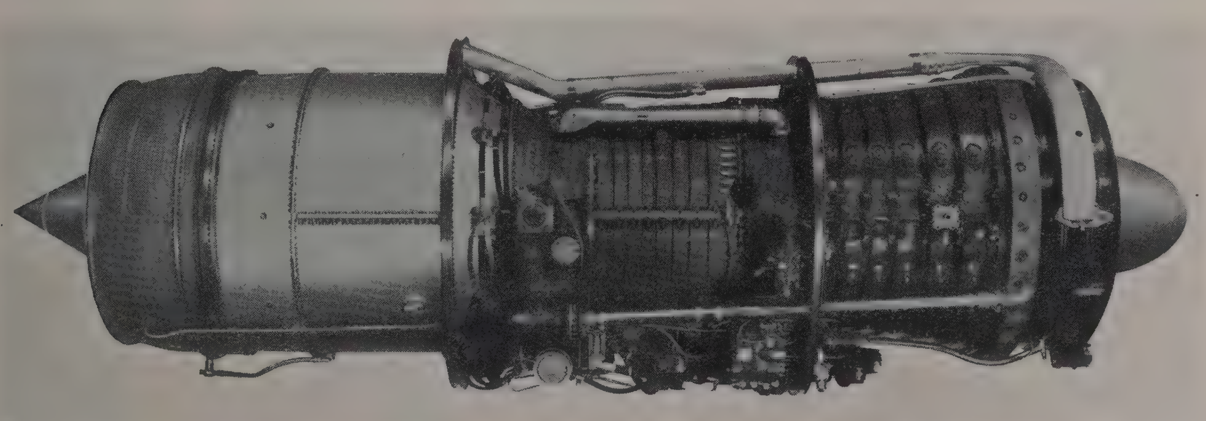
The first Bristol turbojet, the Olympus, employs a compounded, or "two-spool," compressor system which overcomes the restrictions on the choice of pressure ratio. By this means it has been possible to design for and obtain a fuel economy not within the reach of a single-shaft engine.

On August 29, 1955, the Canberra used for flight development of the Olympus engine established a new World's Altitude Record of 65,876 ft. (20,092 m.).

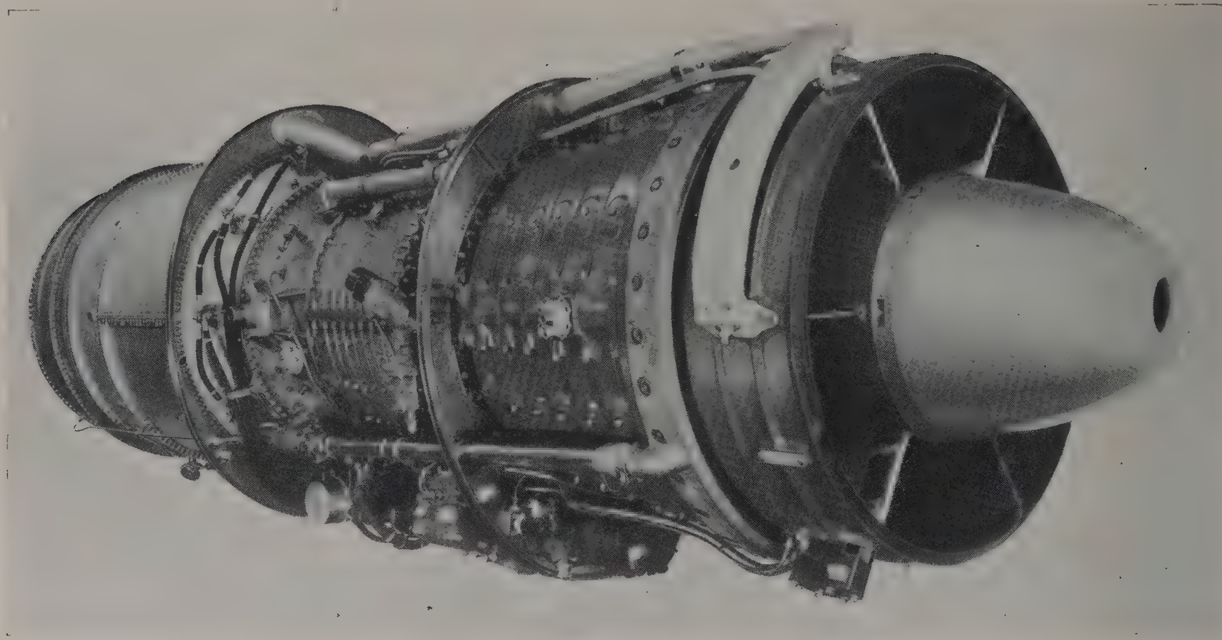
In view of the increasing interest in, and possible future demand for an engine of medium thrust as a power-unit for lightweight tactical and interceptor fighters, the Bristol company announced early in 1954 that it was developing a single-spool lightweight turbojet engine to be known as the Orpheus.

The Orpheus engine ran for the first time on December 17, 1954, and within less than five months the initial version had completed a 150-hours Type Test at 3,285 lb. thrust—giving a thrust/weight ratio of 4.4 lb. thrust per lb. weight.

The Orpheus is specified for the Folland Gnat and for a number of other light fighter aircraft, including the Fiat G.91,



The Bristol Olympus Mk. 101 turbojet engine (11,000 lb.=5,000 kg. s.t. at sea level).



The Bristol Olympus Mk. 101 turbojet engine (11,000 lb.=5.000 kg. s.t. at sea level).

the Breguet Type 1001 and the Dassault Mystère XXVI.

The Bristol company holds licences to manufacture afterburners designed and developed by the Solar Aircraft Company of San Diego, California, and the thrust-reversing system developed by the French SNECMA organisation.

THE BRISTOL OLYMPUS.

The Olympus is the first British turbo-jet engine of the "compound" or "two-spool" type.

The engine consists basically of a low-pressure system and a high pressure system. The high pressure system has a compressor, combustion section and turbine, and may therefore be thought of as a complete gas turbine engine. On an entirely separate shaft, the low pressure system has a compressor fed from the atmosphere and delivering to the H.P. compressor. The low pressure compressor is driven by a low pressure turbine which receives gas from the H.P. turbine and discharges to the jet pipe. By strict analogy the L.P. section therefore acts as an exhaust-driven supercharger for the H.P. section. Since the overall compression ratio is obtained by multiplying together the individual pressure ratios of the L.P. and H.P. systems, these ratios are themselves quite low. The effect of this is to confer the ease of starting and handling associated with a simple low-pressure-ratio engine, with the fuel economy which can only be obtained by high pressure ratio.

The Olympus has been chosen to power the Avro Vulcan four-engined delta bomber, and it is also being manufactured under licence by the Wright Aeronautical Corporation of America. The U.S. military designation of the Olympus is J67.

Development of this engine is proceeding, but no information beyond the following may be published :—

DIMENSIONS.—
Diameter 40 in. (101.6 cm.).
Length (intake flange to exhaust flange) 124 in. (315 cm.).

WEIGHT (BOl.1—Mk. 101).—
3,650 lb. (1,657 kg.).

PERFORMANCE (BOl.1—Mk. 101).—
Max thrust 11,000 lb. (5,000 kg.).

FUEL CONSUMPTION.—
0.766 lb./lb. thrust/hr. (0.766 kg./kg. thrust/hr.).

THE BRISTOL ORPHEUS.

The Orpheus is a single-spool turbojet engine which has been designed to meet the requirement for an engine in the medium thrust range for applications where low weight and small frontal area are of prime importance.

The design has been kept as simple as possible and no provision has been made for anti-icing or any other features which are not required in a lightweight fighter. This enables a robust and efficient engine to be produced with an exceptionally low weight.

The initial version of the Orpheus, which first ran in December, 1954, successfully completed a 150-hour type test in the Spring of 1955, achieving a thrust of 3,285 lb. (1,490 kg.), equivalent to 4.4 lb. thrust per lb. of engine weight, during this test. Other versions under development for the production Folland Gnat and other aircraft are already running at higher powers.

The prototype Folland Gnat Mk. 1, powered by the early version of the Orpheus, made its first flight on July 18, 1955.

The Orpheus, initiated in 1953 by the Bristol company as a private venture, is now the subject of a Ministry of Supply contract.

No further details of this engine were available for publication at the time of writing.

THE BRISTOL PROTEUS 750 SERIES.

This is the first development derivative of the recently introduced 700 Series, from which it differs mechanically by having a new reduction gear designed to take the high output which the Series 700 engine has proved itself able to deliver.

The engine gives 10% more power than the 700 for the same specific fuel consumption and a weight increase of less than 2%. The external dimensions of the engine are unchanged.

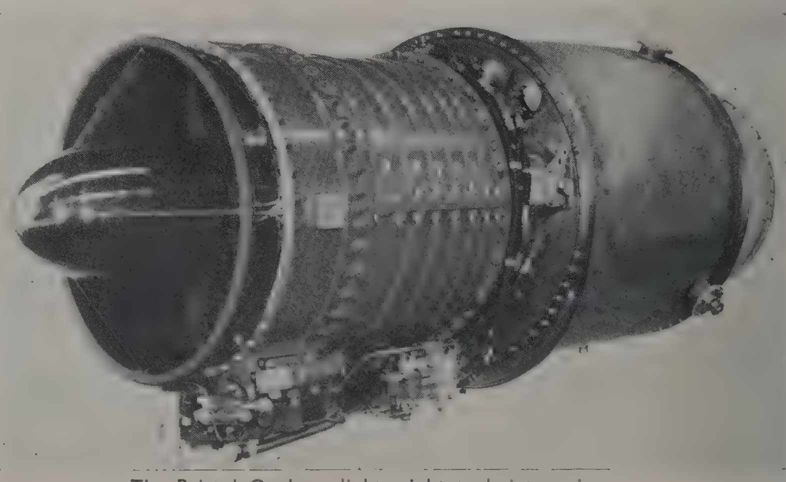
The Proteus 755 of this series will power the larger and more powerful Britannia Marks 200, 250 and 300.

DIMENSIONS.—
Overall diameter 39.5 in. (100 cm.).
Length, cone fitting line to jet pipe 100.5 in. (255.3 cm.).

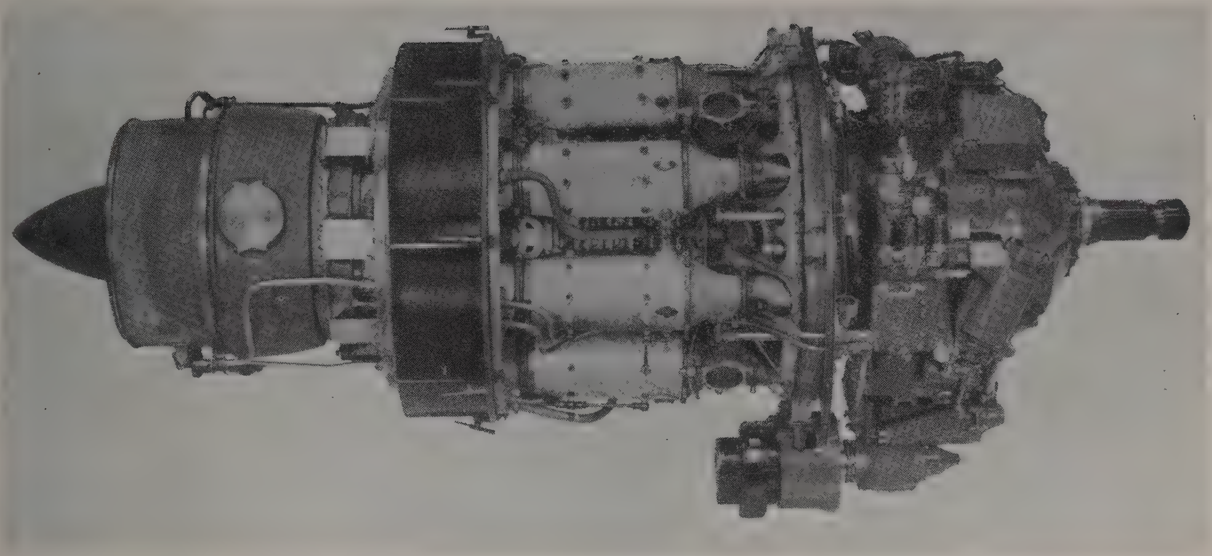
NETT DRY WEIGHT (less exhaust duct and bullet).—
3,000 lb. (1,362 kg.).

PERFORMANCE RATINGS (Preliminary data).—
Take-off (static) 3,650 s.h.p. plus 1,220 lb. (554 kg.) jet thrust at max. compressor r.p.m. at sea level.
Max. continuous power (static) 3,300 s.h.p. plus 1,120 lb. (508 kg.) jet thrust at 97.5% max. compressor r.p.m. at sea level.

CONSUMPTIONS.—
Fuel, at max. power (5 min. limit) 0.71 lb. (.322 kg.) per s.h.p./hr.
Fuel, at max. continuous power 0.480 lb. (0.218 kg.) per e.h.p./hr. at 345 m.p.h. (552 km.h.) and 35,000 ft. (10,675 m.).



The Bristol Orpheus lightweight turbojet engine.



The Bristol Proteus 755 turboprop engine (3,650 s.h.p. plus 1,220 lb.=554 kg. jet thrust).

THE BRISTOL PROTEUS 700 SERIES

The first production version of the Proteus is designated 700 Series. This series, of which the Mk. 705 will power the first fifteen production Bristol Britannia Mk. 100 airliners, has already proved itself capable of exceeding the brochure performance quoted hereunder. The engine is a completely new design in detail, and the latest advances in aerodynamic technique have been brought to bear, particularly in the design of the compressor and turbines. In general layout the engine follows the earlier 600 Series except that a second stage has been added to the compressor turbine, while the centrifugal stage is now located immediately following the axial section, without any intermediate duct or separate bearing for the impeller.

Mechanically, again, the redesign is complete, although care has been taken to preserve in essence the sound features developed during the many thousands of hours of running experience with the 600 Series engines.

In addition, it has been found possible to arrange an air bleed from the compressor sufficient to provide for cabin pressurisation, thus dispensing with the need for a separate compressor and its associated mechanical drive. Provision has been made for hot air for wing de-icing purposes to be tapped off from the turbine casing.

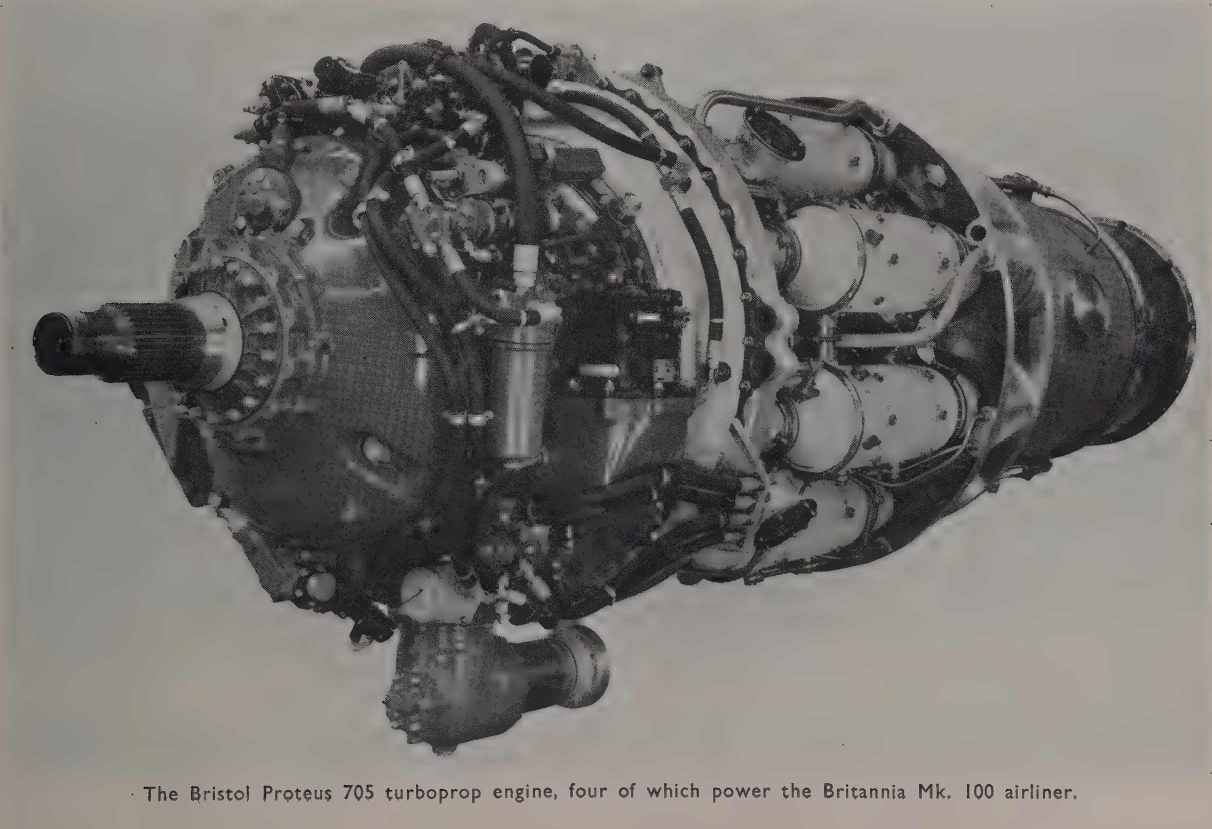
The air intake, still between the compressor and turbine sections, is now a single light alloy casting which, besides being a full structural member of the engine body, provides an aerodynamically efficient entry and eliminates any contamination or heating of the entering air.

The compressor still has twelve axial stages followed by a single centrifugal stage, but has been reduced in diameter, allowing more room for the combustion system, and in length by reducing the pitch of the stages towards the delivery end, as well as by the re-location of the centrifugal impeller.

In the interests of rugged dependability in service, all the blading is now in stainless steel.

The eight combustion chambers remain of the conventional downstream injection type, but have been redesigned on more generous lines, with skin-cooled flame tubes.

The two-stage compressor turbine is of smaller diameter and its performance has been improved, particularly by the introduction of tip shrouds on the rotor blades which minimise the losses at this point. The 600 Series engines had an unshrouded single stage power turbine, but this has been replaced on the 700 Series engines by a two-stage turbine, of which the first has shrouds. Following previous Bristol practice, the drives from the two turbines are entirely independent.



The Bristol Proteus 705 turboprop engine, four of which power the Britannia Mk. 100 airliner.

The compound epicyclic reduction gear follows previous design practice and incorporates a hydraulic torquemeter operated by the reaction on the stationary member of the epicyclic train, and a parking brake to prevent the propellers of a parked aircraft from being windmilled.

Mounting has been simplified and the engine is now carried at four points in the plane of the centrifugal impeller.

The following description and specification refers to the Proteus 705, four of which power the Britannia Mk. 100 airliner.

Type.—Turboprop engine with twelve axial and one centrifugal stages of compression and two separate two-stage turbines, one driving the compressor and one the propeller.

Propeller Drive.—Compound epicyclic reduction gear with drive from free turbine. Ratios 11.111 or .909 : 1.

Air Intake.—Radial type between compressor and turbine sections. The intake is a single light alloy casting and is a full structural member of the engine body. Inlet air flow 43 lb. (19.5 kg.) per sec. Provisions for de-icing.

Compressor.—Twelve axial stages followed by a single centrifugal stage. Axial rotor made up of twelve discs bolted to shaft. Rotor blades (714) secured in axial grooves of "fir-tree" section. Stator blades (644) held in circumferential grooves of "dovetail" section in light alloy two-piece casing. Single steel centrifugal impeller has 31 vanes and is flanged and bolted to shaft. Radial diffuser of high-temperature aluminium-alloy directs air to eight transfer ducts leading to combustion chambers. Compression ratio 7.2 : 1. Mass air flow 43 lb. (19.5 kg.) per sec.

Combustion Chambers.—Eight tubular chambers of mild steel with concentrically mounted flame tubes of Nimonic alloy. Lucas Simplex burners with downstream injection. K.L.G. igniter plugs in primary zone of two flame tubes. Rotax H.T. booster coil.

Fuel System.—Lucas system incorporating fuel pump, throttle valve, barometric pressure control, H.P. shut-off cock and burners. Maximum fuel pressure 1,400 lb./sq. in. (98.4 kg./cm.^{2}). Water injection available for special performance.

Fuel Grade.—D.E.R.D. 2482.

Nozzle Guide Vanes.—Eighty Nimonic alloy blades precision cast in segments of 3 or 7 blades.

Turbine.—Two separate two-stage axial turbines, first driving the compressor and second the propeller reduction gear through bore of compressor rotor. All blades machined from Nimonic alloy and secured to stainless steel rotor discs by "fir-tree" roots. 80 blades in first stage, 70 in second, 56 in third and 64 in fourth. Gas temperatures 847°C. before turbine, 500°C. after turbine.

Jet Pipe.—Fixed. Austenitic stainless steel jet pipe and inner cone.

Accessory Drives.—From main reduction gear below engine to auxiliary box, which has drives for all accessories, including generator and cabin blower.

Lubrication System.—Dry sump. Bristol gear type pump and accessories. Oil tank capacity 14 Imp. gallons, including air space and feathering compartment.

Oil Specification.—DTD.2479.

Mounting.—Four-point mounting with pads in plane of centrifugal impeller.

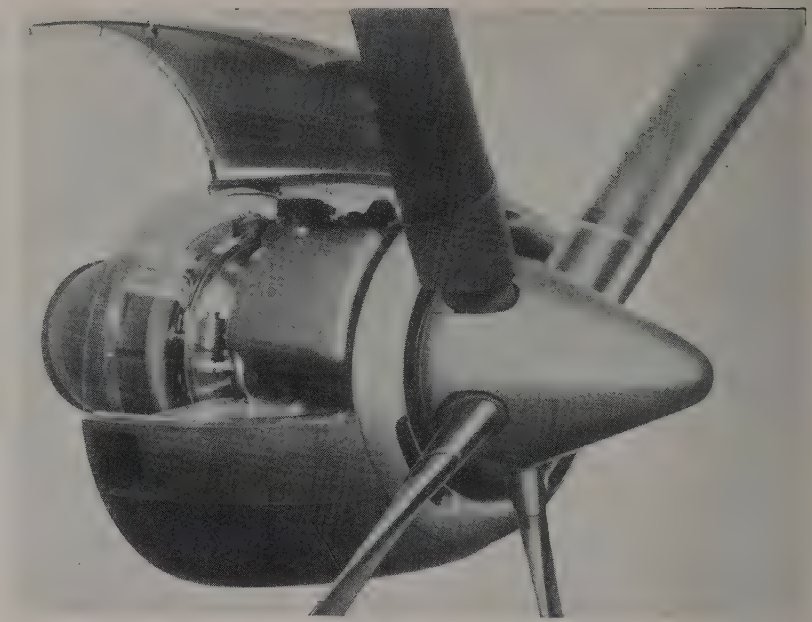
Starting.—Electric starter on gear case. Plessey starting pump.

Dimensions.—
Overall diameter 39.5 in. (100 cm.).
Length (from cone fitting line to jet pipe) 100.5 in. (255.3 cm.).
Frontal area 8.5 sq. ft. (0.78 m.^{2}).

Net Dry Weight.—
2,810 lb. (1,273 kg.).

Performance Ratings.—
Take-off (static) 3,320 s.h.p. plus 1,200 lb. (545 kg.) jet thrust at 12,000 compressor r.p.m. at sea level.
Max. continuous power 2,920 s.h.p. plus 1,100 lb. (500 kg.) jet thrust at 11,700 compressor r.p.m. at sea level.

Consumptions.—
Fuel 0.495 lb. (.224 kg.) per e.h.p./hr. at max. continuous power at 345 m.p.h. (552 km.h.) and 35,000 ft. (10,675 m.).
Oil 2 pints (1.13 litres) per hour.



A mock-up of the Bristol BE.25 turboprop power nacelle.

THE BRISTOL BE.25.

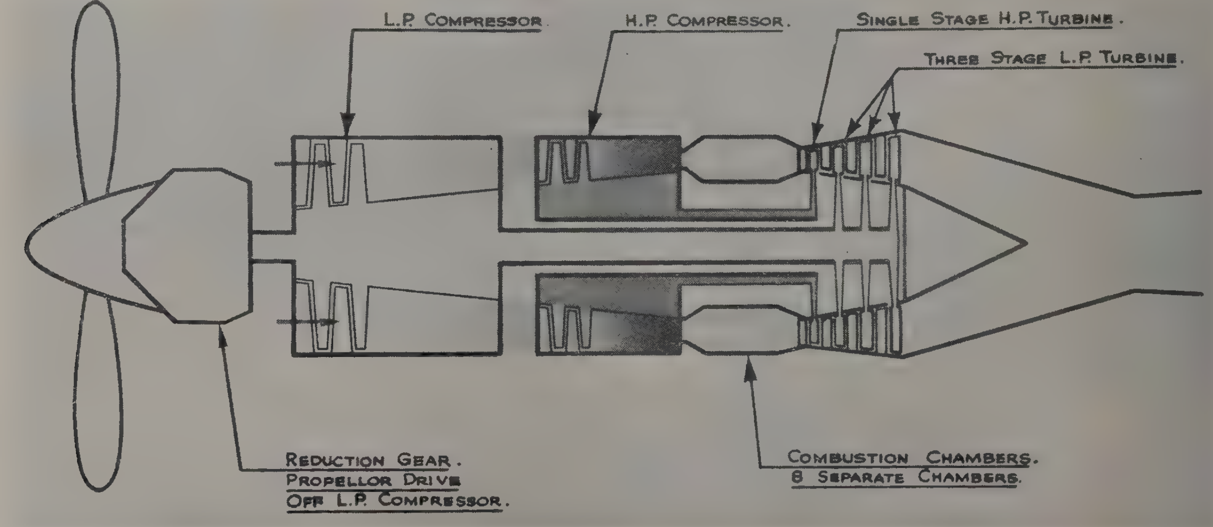
The BE.25 is a new turboprop engine which has been designed specifically for transport operation. It was initiated as a private venture by the Bristol company but has now been made the subject of a Ministry of Supply contract.

The BE.25, the first aircraft engine of a new type known as a supercharged turboprop, combines design features of other Bristol engines, in particular the "free-turbine" of the Proteus turboprop and the "twin-spool" of the Olympus turbojet.

In the BE.25 a single-stage turbine drives the high-pressure compressor and a three-stage turbine drives the low-pressure compressor and provides power for the propeller through a 0.09 : 1 reduction-gear. The combustion system is a turbo-annular and contains ten chambers.

There is no mechanical connection between the H.P. and L.P. compressor/turbine systems. This makes it possible to operate the gas-producing section of the engine at its best efficiency while at the same time the propeller can be operated at its maximum efficiency.

The BE.25 will maintain a constant power output from sea level up to at least 20,000 ft. (6,100 m.). The fuel consumption will be such that, for the first time, a turbine engine will be able



A diagram of the arrangement of the Bristol BE.25 supercharged turboprop engine.

to compete with a diesel engine in economy.

The following are the principal characteristics available at the time of writing.

DIMENSIONS.—
Length 110.3 in. (288 cm.).
Diameter 41.75 in. (106 cm.).

WEIGHT DRY.—
3,050 lb. (1,380 kg.).

PERFORMANCE.—
Shaft h.p. at S/L. 4,000.
Total equivalent h.p. at S/L. 5,050.
Total equivalent h.p. at 36,000 ft. (10,980 m.) at 400 m.p.h. (645 km.h.) 3,080.

CONSUMPTIONS.—
Specific fuel consumption at S/L. 0.647 lb. (0.294 kg.) per e.h.p./hr.
Specific fuel consumption at 36,000 ft. (10,980 m.) at 400 m.p.h. (645 km.h.) 0.385 lb. (0.175 kg.) per e.h.p./hr.

DE HAVILLAND

THE DE HAVILLAND ENGINE COMPANY, LTD.

HEAD OFFICE: LEAVESDEN, HERTFORDSHIRE.

Directors: A. F. Burke, O.B.E., M.Inst.T., F.R.S.A. (Chairman and Managing Director), F. T. Hearle, C.B.E., M.I.P.E., F.R.Ae.S., Sir Geoffrey de Havilland, C.B.E., A.F.C., F.R.Ae.S., R.D.I., W. E. Nixon, F.C.I.S., F. E. N. St. Barbe, J. L. P. Brodie, M.I.A.E., M.I.Mech.E., Dr. E. S. Moult, Ph.D. B.Sc. (Eng.), M.I.Mech.E., F.R.Ae.S. and H. Buckingham.

The de Havilland Engine Co., Ltd. entered the jet-propulsion field in the Spring of 1941. Design of the first D.H. jet engine—the H-1 or Goblin—began in April, 1941, and within a year the prototype was running on the Hatfield test-beds. Within two months the engine was giving its designed thrust, by March 5, 1943, it was flying in a Gloster Meteor, and by September 20, 1943, it was taking the D.H.100 Vampire single-seat single-jet fighter monoplane on its initial flights.

The Goblin powers the D.H. Vampire, for which it was specifically designed.

The Ghost 50 was the first pure jet engine to obtain civil A.R.B. type-approval and was used to power the D.H. Comet 1 and 1A. The Ghost 48 is the power-unit of the D.H. 112 Venom fighter. In addition to its British production, the Ghost is being built under licence in Italy, Sweden and Switzerland.

Under development is the Gyron, de Havilland's first axial-flow turbojet engine.

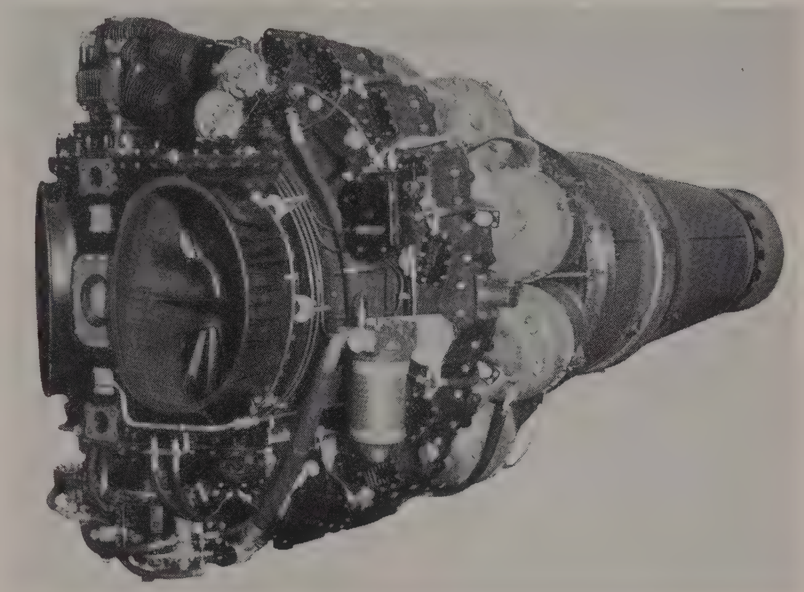
The Sprite introduced in 1949, was the first rocket motor for semi-permanent installation produced in the United Kingdom. It has now been superseded by the Super Sprite which is available for use in both military or civil transport aircraft.

THE DE HAVILLAND GYRON.

It is permitted to mention the existence of a large de Havilland axial-flow turbojet engine known as the Gyron, but at the time of writing few details were available.

Although originally developed as a private venture by the de Havilland company, the Gyron is now the subject of a Ministry of Supply development contract.

The Gyron, which ran for the first time on January 5, 1953, passed its first type-approved test at an initial thrust-rating of 15,000 lb. (6,810 kg.). It began its air testing in the lower port engine nacelle of the Short Sperrin four-engined bomber on July 7, 1955.


The de Havilland Ghost 48 Mk. I turbojet engine.

DIMENSIONS.—
Overall diameter (less accessories) 46.25 in. (117.5 cm.).
Overall length 154 m. (391 cm.).

THE DE HAVILLAND GYRON JUNIOR.

The Gyron Junior, which began test-bed running in the Summer of 1955, is a smaller version of the Gyron. This engine is being developed under a Ministry of Supply contract and at the time of writing no details were available for publication.

THE DE HAVILLAND GHOST 48.

Although larger than the Goblin, the Ghost has the same basic features and simple layout of the lower-powered engine, including a single-sided impeller, a single rigid rotor assembly, straight-through combustion, single-stage turbine and cantilever mounting.

The Ghost 48 is at present available in two forms, the Marks 1 and 2, differing mainly in the fuel systems and in the fact that the Mk. 2 has provision for two alternators with a correspondingly larger output. Under active development is the Ghost 48 Mk. 3 of which no details were available at the time of closing for press.

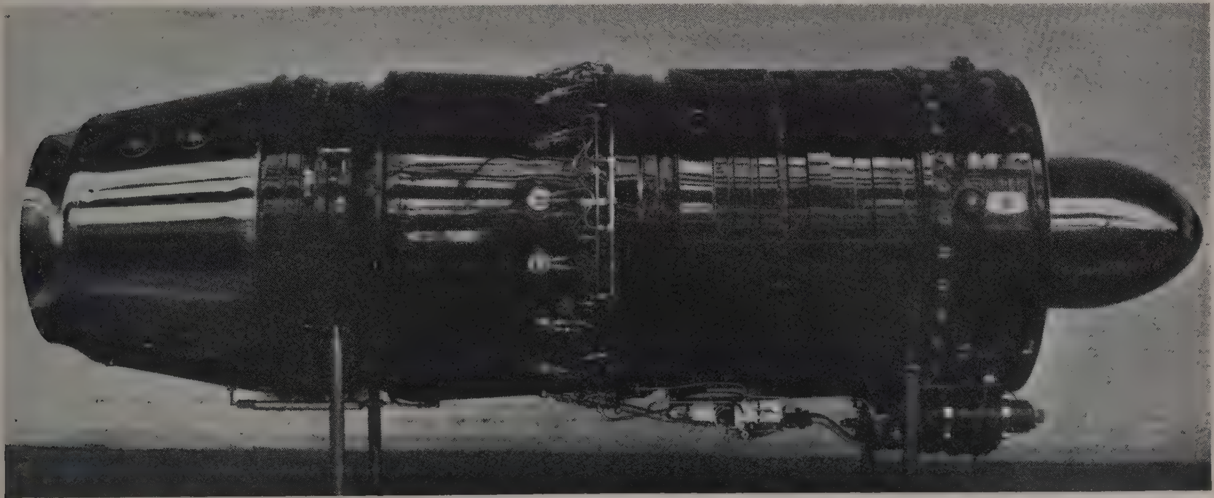
TYPE.—Centrifugal-flow turbojet with single-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor with forged aluminium-alloy single-sided 19-vane impeller. Aluminium-alloy casing and two-piece magnesium-alloy diffuser with 20 tangential outlets. Rotative assembly rims on one ball and one roller (rear) bearing. Compression ratio 4.5 : 1. Air mass flow 88 lb. (40 kg.) per sec. at 10,250 r.p.m. at sea level.

COMBUSTION CHAMBERS.—Ten straight-flow chambers each containing a concentrically-mounted perforated flame tube. Fuel injection nozzle in front end of flame tube. Around each nozzle is a small perforated shroud admitting 30% of the air flow for primary combustion. Remainder of air passes around front end of flame tube and enters it through the perforations.

FUEL SYSTEM (Mk. 1).—Lucas twin-pump system. Two multi-plunger variable-stroke fuel pumps with overspeed governors and relief valves. Lucas baro-metric pressure control, throttle valve, shut-off cock, low and high-pressure fuel filters and Lucas burners are fitted.

FUEL SYSTEM (Mk. 2).—Dowty spill flow


The de Havilland Gyron turboprop engine which has an initial thrust rating of 15,000 lb. (6,810 kg.).

system. Positive-displacement supply pump with overspeed governor and by-pass valve, and positive-displacement multi-plunger re-circulating pump and valve group unit. Dowty flow control and air/fuel ratio control, low-pressure fuel filter and Dowty spill flow burners.

FUEL.—Normal kerosene and gasolene turbine fuels.

TURBINE.—Single-stage turbine. Turbine disc of alloy steel has 97 inserted solid blades of Nimonic 90. Both sides of disc cooled by air tapped from compressor. Cast steel shroud has 70 inserted nozzle guide vanes of Nimonic 80.

JET PIPE.—Steel outer casing and fixed inner cone. Sheet steel insulating shroud with air space between it and outer casing.

LUBRICATION —Front bearing lubricated direct from main pump. Rear bearing pressure-lubricated by Tecalemit micro-pump; scavenging pump and Tecalemit filter.

STARTING.—Rotax turbo starter.

DIMENSIONS.—
Max. diameter 53 in. (1,346 mm.).
Overall length to rear flange of exhaust cone 116 in. (2,946 mm.), standard exhaust cone being 51 in. (1,295 mm.) long to which is added 6.5 in. (16.5 cm.) for the propelling nozzle and cuff.

NET DRY WEIGHT.—
2,120 lb. (962 kg.) ± 2½%.

RATING.—
Max. static thrust 4,850 lb. (2,200 kg.) at 10,250 r.p.m.

CONSUMPTION (at max. static thrust).—
1.21 lb./lb. thrust/hr. (1.21 kg./kg. thrust/hr.) at sea level.

THE DE HAVILLAND GOBLIN 35.

TYPE.—Centrifugal-flow turbojet with single-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor with single-sided impeller. Compression ratio 3.67 : 1. Impeller fabricated from heat-treated aluminium-alloy stamping, has 17 vanes and is 31 in. (78.74 cm.) in diameter. Pivot shaft is shrunk in and bolted to front face of impeller and carries bevel gear which drives accessory shaft. Rotative assembly runs in two ball-bearings, the rear in a sliding housing to allow for rearward expansion. Bearings lubricated by metered oil flow from two metering pumps driven by accessory shaft. Rear bearing is air-cooled by air bled from diffuser.

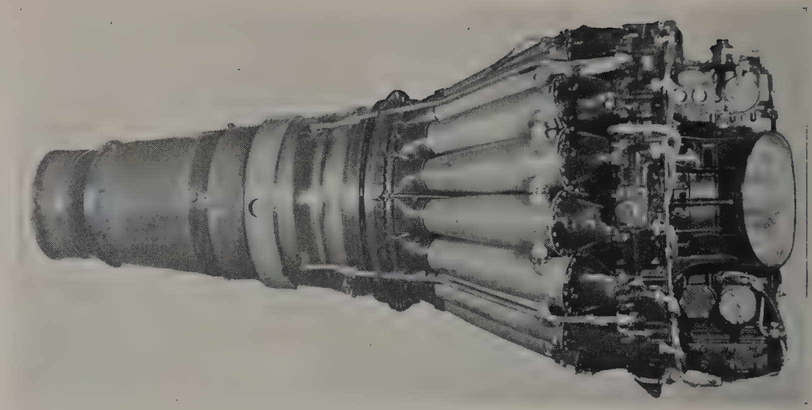
COMPRESSOR HOUSING.—In three sections. Front section of aluminium-alloy is a ribbed unit forming the two entry orifices and carries front bearing of rotor assembly and all accessories with their bevel-drive gears. Other two sections in magnesium-alloy bolted together to form diffuser, incorporating cascade guide vanes to smooth flow through right angle to combustion heads. Conical steel casing forms main lengthwise member of engine structure. Small end of centre cone is fixed to rear bearing housing just in front of turbine disc.

COMBUSTION CHAMBERS.—Sixteen straight-flow chambers with upstream ends bolted to rear face of diffuser chamber and downstream ends a sliding fit, with piston ring type seals, in turbine nozzle junction-box assembly. Combustion chamber outer casing in two parts, front half being an aluminium-alloy die casting and rear half a mild steel deep drawing. Flame-tube in two parts fabricated from 20 s.w.g. Nimonic 75.

FUEL SYSTEM.—Fuel is fed from aircraft fuel-system by immersed pump to engine rotary type fuel pump. Pump is rated at 585 Imp. gallons (2,657 litres) per hour at 1,000 lb./sq.in. (70.3 kg./cm.²) at 3,500 r.p.m.-10,500 r.p.m. engine speed. From pump, fuel passes through fuel control containing metering orifice, area of which is controlled by a metering needle which is so calibrated that equal movements of pilot's throttle will give equal increments of thrust From fuel control box fuel passes to a barometric pressure control, a fuel accumulator, and automatic starting valve and into burner supply ring. 16 burners, of fixed orifice type, are inserted into combustion chambers through bosses cast in diffuser casing and are connected by flexible pipes to fuel supply ring.

FUEL.—Normal kerosene and gasoline turbine fuels.

TURBINE.—Single-stage turbine. Turbine disc of special D.12 steel with 83 blades of Nimonic 80A mechanically attached in serrated slots broached in periphery of disc. Turbine ring separated from main casing by cylindrical sheet metal skirt which connects nozzle ring at its inner periphery with conical centre casing about half-way along its length, and by diaphragm plate which connects nozzle with rear bearing housing which in conjunction with reflector plate, shields rear bearing from high turbine temperatures. Nozzle blades are drop stampings in Nimonic 80.



The de Havilland Goblin 35 turbojet engine.

JET PIPE.—Sheet steel exhaust cone bolted to turbine shroud-ring tapers to an orifice 16⅜ in. (41.6 cm.) in diameter. Within jet pipe is an inner cone of sheet steel supported by two pairs of radial streamlined stays. Two of front stays are used to transmit air from diffuser casing to rear of turbine disc. Annular heater-muffs for warming aircraft cabins, guns and, in case of arctic operation, oil sump in front of engine, are welded on to outside of jet pipe. Pipe is finally enclosed in cowling through which air for cooling and insulating is drawn rearwards by suction of jet itself. Jet-pipe temperatures 710°C. maximum, 610°C. maximum continuous.

LUBRICATION.—Oil sump of about 12 pints (6.825 litres) capacity, bolted on to bottom accessory-drive gear-box on front casing. Gear-type pressure pump delivers oil to accessories and their drives and two metering pumps attached to and fed by pressure pump, feed the two bearings of rotor assembly. Oil from compressor end-bearing returns to sump while that from turbine end is drained to waste at a common drain box. Normal oil pressure at cruising r.p.m. is 35-45 lb./sq. in. (2.45-3.2 kg./cm.²) at 8,700 r.p.m. Maximum oil consumption 2 pts./hr.

STARTING.—Interconnected fuel and ignition system by which rotor is slowly spun up to a speed where sufficient air flows through to ensure ignition when fuel is admitted. When this stage is reached automatic starting valve allows fuel to be injected into burners from fuel accumulator. Igniter-plugs in two combustion chambers are automatically energised. Interconnecting elbows between all chambers ensure propagation of flame round engine and serve as pressure equalisers during normal running.

DIMENSIONS.—
Max. diameter 49.85 in. (1,267 mm.).
Installed diameter (Vampire) 54 in. (1,370 mm.).
Length to rear flange of standard exhaust cone 100.5 in. (2,550 mm.).

NET DRY WEIGHT.—
1,629 lb. (739.5 kg.) + 2½%.

RATINGS.—
Max. static thrust 3,500 lb. (1,589 kg.) at 10,750 r.p.m.
Max. continuous 3,000 lb. (1,363 kg.) at 10,250 r.p.m.
Economical cruising 2,320 lb. (1,043 kg.) at 9,500 r.p.m.
Idling 155 lb. (70 kg.) at 3,000 r.p.m.

CONSUMPTION.—
Sea level static at 10,750 r.p.m. 1.16 lb./lb./hr. (1.16 kg./kg./hr.) at 9,500 r.p.m. 1.20 lb./lb./hr. (1.20 kg./kg./hr.).

THE DE HAVILLAND SUPER SPRITE.

The Super Sprite is a development of the earlier Sprite and is a liquid fuel assisted take-off rocket motor which is intended for either permanent or jettisonable installation on military or transport aircraft. The Super Sprite employs hydrogen peroxide as the oxidant with kerosene or petrol injection to boost the rocket thrust either in magnitude or duration. A solid catalyst breaks down the hydrogen peroxide into gaseous steam and oxygen; this ensures a smokeless exhaust.

The Super Sprite produces a total impulse of 120,000 lb./sec. (54,430 kg./sec.) normally with a maximum thrust of 4,200 lb. (1,905 kg.) and a duration of 40 seconds, but both the maximum thrust and total duration can be altered within certain limits to suit different installations. Unlike rockets using solid propellants the Super Sprite can be shut down at any time during the firing by simply turning off a switch.

The propellants are contained in two separate tanks, the hydrogen peroxide in a 57 gallon (259 litre) stainless steel tank situated in front of the motor, and the kerosene or wide-cut gasoline in a 5 gallon (23 litre) tank surrounding the propelling nozzle. The propellants are transferred to the combustion chamber by the pressure of nitrogen gas which is stored in nine bottles surrounding the combustion chamber.

The cockpit controls consist only of two switches, one of which is a safety switch which prevents the accidental operation of the unit. Until both switches are closed the motor cannot be started.

Because the Super Sprite is self-contained a jettisonable nacelle capable of being dropped from an aircraft, recovered and, after a minimum of servicing, re-installed for the next take-off, has been developed. The nacelle is equipped with a parachute and parachute release-gear for the descent and a self-inflatable air-bag to cushion the impact of the nacelle with the ground. The parachute gear has been designed to give a rate of descent of 25 ft./sec. (7.6 m./sec.). The nacelle can be released from as low as 1,000 ft. (305 m.) and at speeds of up to 290 m.p.h. (465 km.h.).

The Super Sprite was the first British rocket engine to receive official type approval for quantity production and general service use.

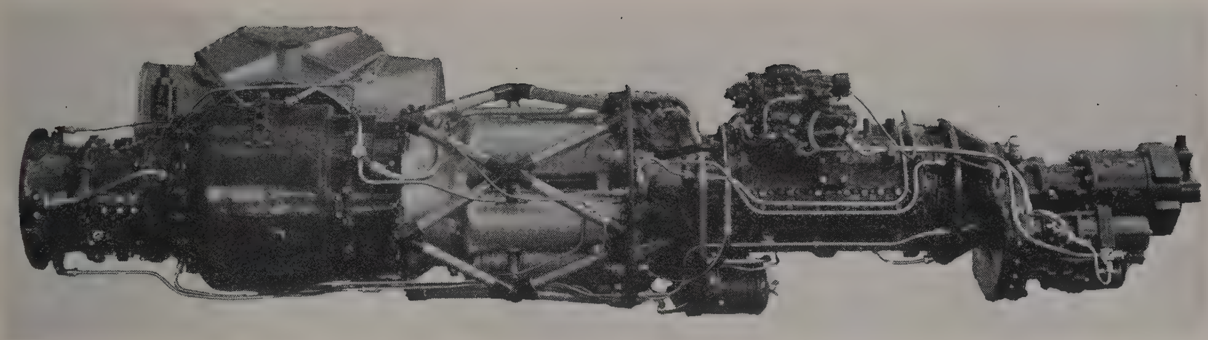
DIMENSIONS.—
Overall diameter 20.5 in. (51.4 cm.).
Overall length 117.25 in. (297.8 cm.).

WEIGHTS.—
Dry 620 lb. (281.2 kg.).
Fueled 1,460 lb. (662.2 kg.).

PERFORMANCE.—
Max. thrust 4,200 lb. (1,095 kg.).
Duration at max. thrust 40 sec.

THE DE HAVILLAND SPECTRE.

The Spectre is a liquid-propellant rocket motor which has been specifically designed for installation as part of the power-plant of interceptor fighters to enable them to achieve outstanding rate of climb and very high supersonic speeds, plus the ability to accelerate and manoeuvre at altitudes well above the limits set by the conventional air-breathing jet engine. No details of the Spectre were available for publication at the time of closing for press.



The Napier Oryx turbo gas-generator for jet helicopter propulsion.

D. NAPIER & SON, LTD.

HEAD OFFICE: ACTON, LONDON, W.3.

WORKS: ACTON, LONDON, W.3., AND EAST LANCASHIRE ROAD, LIVERPOOL, 10.

Directors: Sir George H. Nelson (Chairman), Brig. General Wade H. Hayes, O.B.E., P. Horsfall, H. G. Nelson, A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., Air Vice-Marshal Sir Conrad Collier, K.C.B., H. Sammons, C.B.E., M.I.Mech. E., F.R.Ae.S. (Managing).

When the evolution of the gas turbine engine foreshadowed the obsolescence of the piston engine the Napier Company embarked on a programme of gas turbine design and development.

The first of the new Napier engines to be announced was the Naiad, a 1,500 h.p. turboprop engine with twelve-stage axial-flow compressor and a two-stage turbine. A coupled Naiad consisting of two single engines side-by-side and driving co-axial contra-rotating airscrews through a common gear box was also announced. Both these engines have been described in previous editions.

Recent Napier power-plant developments of which details may be published, include the Nomad compounded engine, the Eland turboprop engine, which develops 3,000 e.h.p., and the Oryx turbo gas-generator.

In 1954 Napier bought a Convair 340 airliner to equip it with two Eland turboprop engines for test and demonstration purposes.

THE NAPIER ORYX.

The Oryx is a gas-generator of the single shaft gas-turbine type, which has been developed as a power-unit for jet-driven helicopters. Two Oryx gas producers will be used in the Hunting Percival P.74 helicopter.

The Oryx comprises a main axial-flow compressor, five combustion chambers, a turbine and an auxiliary axial-flow compressor. Exhaust gases from the turbine and the separate air delivery from the auxiliary compressor are mixed after the collector which delivers to a two-position non-throttling valve. The function of this valve is to divert the gases either to the starting nozzle or rotor head as required.

TYPE.—Turbo gas-generator.

AIR INTAKE.—Plenum chamber with side intakes.

MAIN COMPRESSOR.—Axial-flow type. Rotor mounted on roller bearings at inlet end and ball bearings at outlet end.

AUXILIARY COMPRESSOR.—Axial-flow type. Rotor on roller bearing at inlet and ball bearing at outlet.

COMBUSTION CHAMBERS.—Five tubular chambers with upstream fuel injection. High-energy spark ignition in two chambers.

FUEL SYSTEM.—Single lever operates Napier fuel metering control unit, with automatic compensation for variations in flight conditions.

FUEL GRADE.—Aviation Turbofuel D.Eng. R.D. 2482 or, alternatively, wide-cut Gasoline D.Eng.R.D. 2486.

TURBINE.—Axial-flow. Turbine shaft on roller bearing at inlet end and ball bearing at outlet end.

ACCESSORY DRIVES.—Fuel pump, oil pumps and r.p.m. generator gear-driven from shaft at entry end of high-pressure compressor at front of engine.

LUBRICATION SYSTEM.—Vane-type pressure pump with filter incorporated and vane-type scavenge pumps. Main engine oil pressure 80 lb./sq. in. (5.625 kg./cm.^{2}).

OIL SPECIFICATION.—Synthetic DERD 2487.

MOUNTING.—Pads on support plate of main compressor and on collector casing.

STARTING.—Rotax type EXP. 4790 electric starter mounted co-axially with and forward of main compressor.

DIMENSIONS.—

Max. diameter (excluding collector) 19.25 in. (49 cm.).

Overall length (excluding accessories) 83.5 in. (211 cm.).

NET DRY WEIGHT.—

495 lb. (224.5 kg.) + $2\frac{1}{2}$%.

PERFORMANCE RATINGS (S/L. Static ICAN conditions).—

Max. take-off and operational necessity 750 gas h.p.* at 21,900 r.p.m.

Max. continuous 610 gas h.p. at 21,000 r.p.m.

FUEL CONSUMPTIONS.—

At max. take-off and operational necessity output 0.68 lb./g.h.p./hr. (0.308 kg./g.h.p./hr.).

At max. continuous output 0.735 lb./g.h.p./hr. (0.33 kg./g.h.p./hr.).

* *Gas h.p. is the power which would be obtained from the flow of gas through a turbine having an adiabatic efficiency of 100 per cent.*

THE NAPIER ELAND N.El.1.

TYPE.—Turboprop engine with ten-stage axial compressor, six combustion chambers and three-stage turbine.

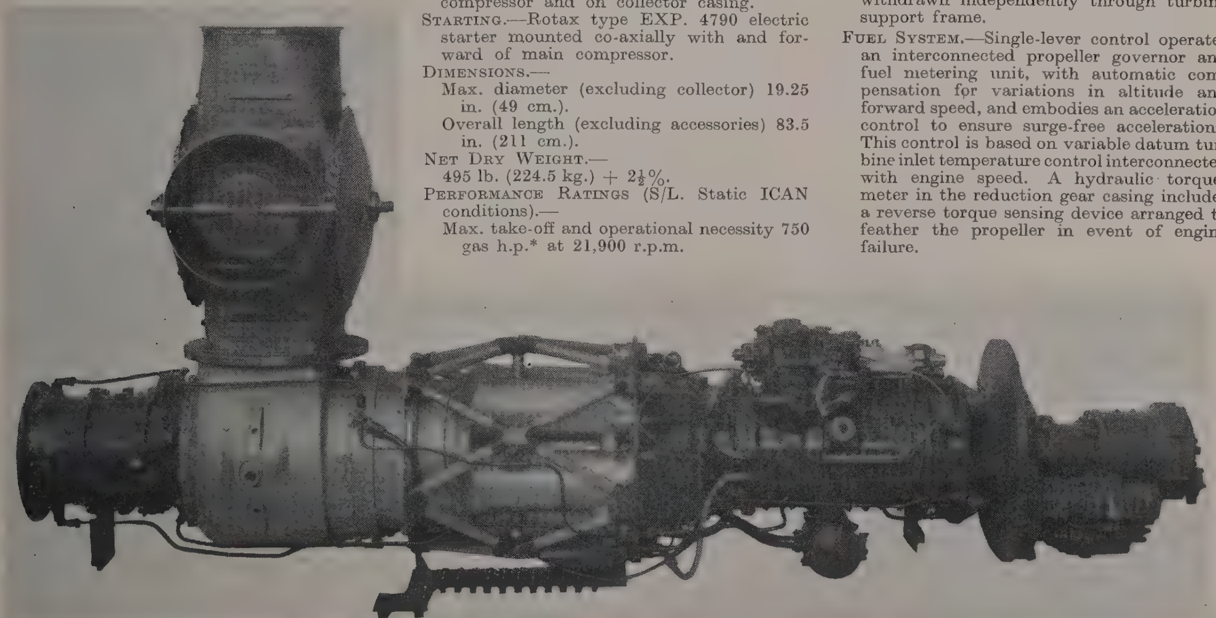
PROPELLER DRIVE.—Compound epicyclic reduction gear, incorporating hydraulic torquemeter, driven from extension of compressor shaft. Following gear ratios can be provided: .0714, .0838, .0912 or .0972.

AIR INTAKE.—Annular forward facing intake surrounding reduction-gear casing immediately behind propeller. Inner wall of intake anti-iced by reduction gear oil, outer wall by oil-heated jackets. Six spats in intake anti-iced by oil and variable-inlet guide vanes by air tapped from compressor.

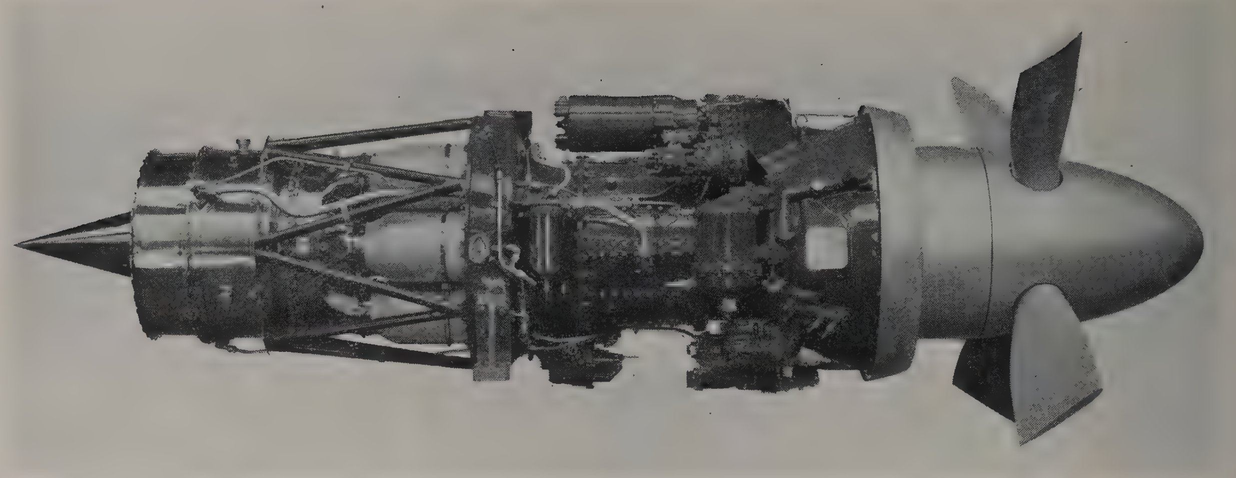
COMPRESSOR.—Ten-stage axial compressor. Aluminium compressor casing cast in halves. Compressor shaft on ball and roller bearings at front and roller bearing at rear. Aluminium bronze blades throughout, the rotor blades being secured by "fir-tree" roots to aluminium and steel discs which, in turn, are splined to compressor shaft. First four stater stages of shrouded type, remainder of cantilever type. Compression ratio 7 : 1.

COMBUSTION CHAMBERS.—Six detachable tubular chambers. Outer casings of S.84 material, flame tubes in DTD.703. Upstream injection type burners. High energy spark ignition in two chambers. Chambers secured by clamping rings which, when released, permit each chamber to be withdrawn independently through turbine support frame.

FUEL SYSTEM.—Single-lever control operates an interconnected propeller governor and fuel metering unit, with automatic compensation for variations in altitude and forward speed, and embodies an acceleration control to ensure surge-free accelerations. This control is based on variable datum turbine inlet temperature control interconnected with engine speed. A hydraulic torquemeter in the reduction gear casing includes a reverse torque sensing device arranged to feather the propeller in event of engine failure.



The Napier Oryx with the latest type of vertical gas delivery duct for the Hunting Percival P.47 helicopter.



The Napier Eland N.El.1 turboprop engine (2,690 s.h.p. plus 825 lb. (318 kg.) jet thrust).

FUEL GRADE.—Wide-cut gasoline (D.E.R.D. 2486) or Aviation turbofuel (D.E.R.D. 2482).

TURBINE.—Three-stage axial-flow. First stage nozzles cast in X40 material and are secured in inner and outer rings. Second and third stage nozzle blades, cast in same material with inner and outer platforms, are bolted to external turbine casing. First stage rotor blades, are in Nimonic 90, second and third stages in Nimonic 80A. Rotor blades have "fir-tree" type root fittings. Turbine rotor discs, in H40 material, splined to shaft. Turbine shaft supported at front end by gear type coupling driving compressor, and at rear end by ball bearing.

JET PIPE.—Fixed nozzle type. Pipe and cone of Nimonic 75.

ACCESSORY DRIVES.—Accessories are mounted on reduction gear casing and are driven from front of compressor shaft. A splined shaft is provided for an aircraft accessory gear box and is situated above front end of compressor. Pressure oil pump, torquemeter pump and scavenge pumps are driven from a shaft at rear end of propeller shaft and are mounted below engine. Fuel pump, tachometer and propeller governor are driven from accessory gear-box drive and are mounted on top of engine.

LUBRICATION SYSTEM.—Pressurised jet feeds to bearings and gearing. Oil pressure and main scavenge pumps are of gear type, auxiliary scavenge pumps for compressor and turbine bearings are of vane type. All these components are manufactured by Napier. Normal oil pressure 80 lb./sq. in. (5.6 kg./cm.²).

OIL SPECIFICATION.—Synthetic oil (D.E.R.D. 2487).

MOUNTING.—Single-plane type. Three mounting pads on support plate at rear of compressor.

STARTING.—Rotax electric starter, Type C.9401, mounted above front end of compressor casing, drives engine *via* accessory gear-box drive.

DIMENSIONS.—
- Diameter $36\frac{1}{16}$ in. (91.6 cm.).
- Length overall (from front end of propeller shaft to turbine exit flange) $105\frac{1}{8}$ in. (267 cm.).
- Frontal area 7.1 sq. ft. (0.66 m.²).

WEIGHT.—
- Dry 1,575 lb. (715 kg.).
- Complete with starter and propeller governor 1,661 lb. (754 kg.).

PERFORMANCE (S/L. Static I.C.A.N. conditions).—
- Max. take-off 2,690 s.h.p., plus 825 lb. (374.5 kg.) net jet thrust at 12,500 r.p.m. (3,007 equivalent h.p.).
- Max. continuous 2,070 s.h.p., plus 700 lb. (317.8 kg.) net jet thrust, at 12,000 r.p.m. (2,340 equivalent h.p.).
- Typical cruising 1,665 s.h.p., plus 585 lb. (265.6 kg.) net jet thrust, at 11,500 r.p.m. (1,890 equivalent h.p.).

FUEL CONSUMPTIONS.—
- At max. T.O. output .625 lb. (.28 kg.) /e.h.p./hr.
- At max. continuous output .659 lb. (.29 kg.)/e.h.p./hr.
- At typical cruising .688 lb. (.31 kg./e.h.p./hr.).

OIL CONSUMPTION.—
- 2 pints (1.1 litres) per hour.

THE NAPIER ELAND N.El.3.

This engine is an adaptation of the standard engine for helicopter application. It consists of an Eland turboprop engine with an auxiliary compressor mounted co-axially at the rear. This compressor when required is driven from the turbine *via* a hydraulic coupling.

Two Eland N.El.3 engines will power the Fairey Rotodyne.

Design details of the N.El.3 are as for the N.El.1. Details of the additional components follow.

AUXILIARY COMPRESSOR.—Nine-stage axial-flow compressor with rearward-facing intake. Compressor rotor on ball bearing at inlet end and roller bearing at outlet. Aluminium-bronze blades used throughout. First three stator stages of shrouded type, remainder of cantilever type.

HYDRAULIC COUPLING.—Of traction type with two impellers driven from engine shaft and two runners on a common shaft driving auxiliary compressor. Oil for filling coupling supplied from main pressure line by means of separate booster pump, and this oil also used for cooling the coupling when not driving compressor.

JET PIPE.—Bifurcated type, each pipe with fixed nozzle.

LUBRICATION SYSTEM.—Pressure jet feeds to bearings and gearing. All pumps of gear type and manufactured by Napier. Main oil pressure 80 lb./sq. in. (5.625 kg./cm.²).

MOUNTING.—A frame bolted to pads on main support plate forms the engine mounting structure and is bolted direct to aircraft bulkhead mounting fitments.

DIMENSIONS.—
- Diameter 36.0625 in. (91.6 cm.).
- Length (from front of airscrew shaft to auxiliary compressor inlet flange) 158.25 in. (402 cm.).
- Frontal area 7.1 sq. ft. (0.65 m.²).

WEIGHT DRY.—
- Including engine mounting frame but without final jet pipes 2,350 lb. (1,067 kg.) + $2\frac{1}{2}$%.

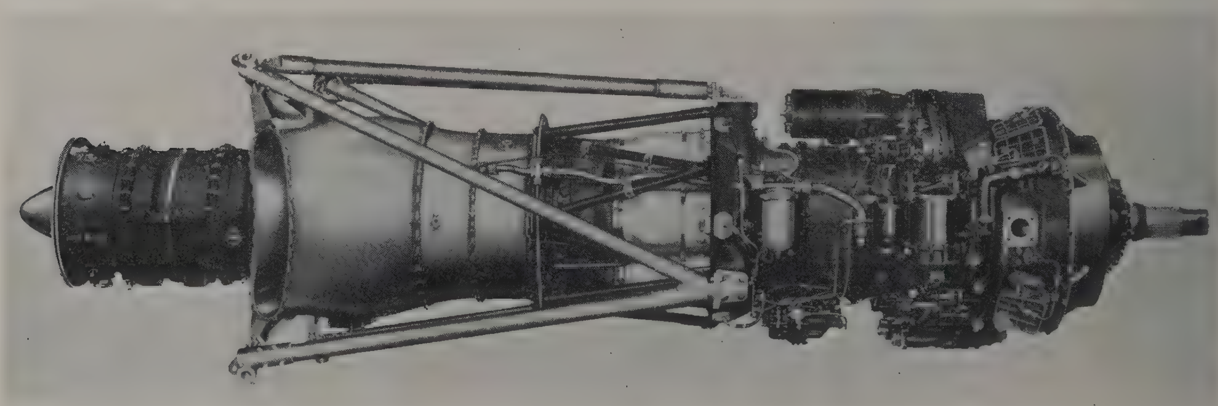
PERFORMANCE (S/L. Static I.C.A.N. conditions).—
- Max. take-off 2,805 s.h.p. plus 500 lb. (227 kg.) net thrust at 12,500 r.p.m. (3,000 equivalent h.p.).
- One hour rating 2,500 s.h.p. plus 480 lb. (218 kg.) net thrust at 12,500 r.p.m. (2,685 equivalent h.p.).
- Max. continuous 2,180 s.h.p. plus 420 lb. (191 kg.) net thrust at 12,000 r.p.m. (2,340 equivalent h.p.).

FUEL CONSUMPTIONS.—
- At max. take-off output 0.625 lb. (0.28 kg.) per e.h.p./hr.
- At one-hour rating output 0.644 lb. (0.29 kg.) per e.h.p./hr.
- At max. continuous output 0.663 lb. (0.30 kg.) per e.h.p./hr.

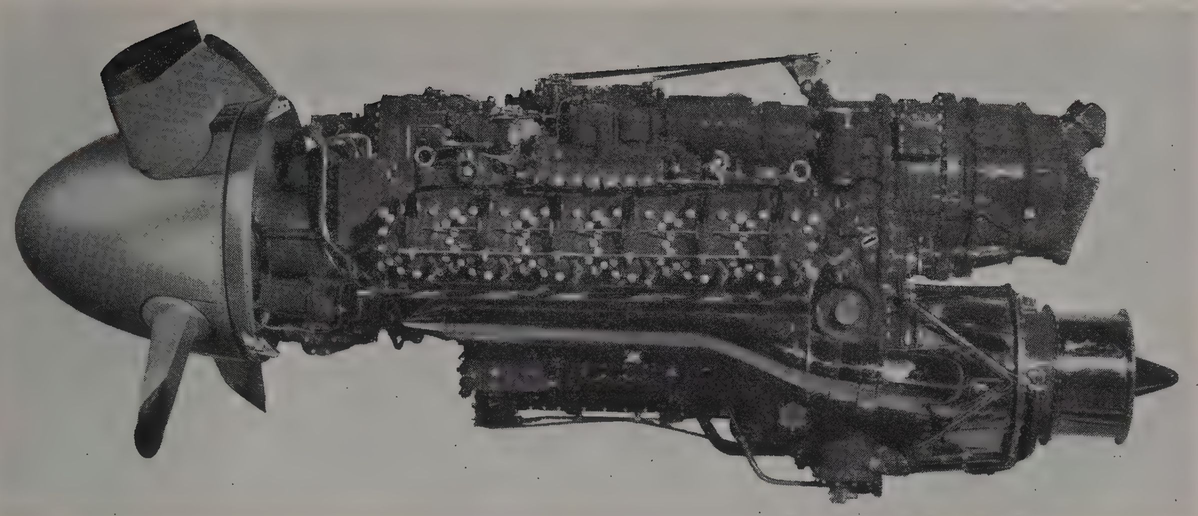
OIL CONSUMPTION.—
- 2 pints (1.1 litres) per hour.

THE NAPIER ELAND N.El.4.

The N.El.4 is a development of the N.El.1. The compressor reduction gearbox and combustion system have been



The Napier Eland N.El.3 turboprop with auxiliary compressor. Two engines of this type will power the Fairey Rotodyne.



The 3,046 s.h.p. Napier Nomad Compounded Diesel/Turbine engine.

retained but the turbine has been redesigned to operate at higher temperatures. All other design details and the overall dimensions are as for the N.El.1.

Net Dry Weight.—
1,800 lb. (817 kg.) + 2½%.

Performance (S/L. Static I.C.A.N. conditions).—
Max. take-off 3,765 s.h.p. plus 610 lb. (277 kg.) net thrust at 12,500 r.p.m. (4,000 equivalent h.p.).
Max. continuous 3,005 s.h.p. plus 515 lb. (234 kg.) net thrust at 12,000 r.p.m. (3,205 equivalent h.p.).

Fuel Consumption.—
At max. take-off output 0.560 lb. (0.25 kg.) per e.h.p./hr.
At max. continuous output 0.586 lb. (0.26 kg.) per e.h.p./hr.

THE NAPIER NOMAD.

The Nomad was designed to provide an aero-engine which would have the lowest possible fuel consumption under any operating conditions. This has been achieved by compounding the simplest form of two-stroke diesel engine with a gas turbine, and transmitting the power through a propeller. This type of engine also enables a wide range of fuels to be used, such as diesel fuel, kerosene and wide-cut gasoline. The low fuel consumption (as compared with a gas turbine, used either for driving a propeller or as a jet engine) is achieved by the use of a high compression ratio and a high expansion ratio, which is made possible by the combination of the diesel engine with a gas turbine.

The Nomad consists of a simple valveless two-stroke diesel engine to which is added a turbine-compressor set. The axial-flow compressor is on a common shaft with a multi-stage exhaust turbine and the turbine-compressor set thus formed is coupled mechanically to the compression-ignition engine through a gear-train incorporating an infinitely-variable gear which is necessary to relate the widely-varying speeds of the two parts of the engine, and also to enable a selected boost to be maintained over a wide range of altitudes.

The power of the compression-ignition engine and the surplus power available from the exhaust gas turbine are transmitted to a common single-rotation propeller shaft by a reduction-gear in the nose of the engine assembly.

Type.—Compound aero-engine comprising a twelve-cylinder opposed Diesel two-stroke compression-ignition unit and a turbo-compressor unit, made up of a twelve-stage axial-flow compressor and a three-stage turbine, the power from the two units being transmitted to airscrew shaft through common reduction gear.

Diesel Engine.

Cylinders.—Bore 6 in. (152.4 mm.). Stroke 7⅜ in. (187.3 mm.). Total displacement 41.1 litres. Two six-cylinder blocks of L.51 aluminium-alloy containing coolant passages. Copper-chrome alloy cylinder liners contain piston-operated inlet and exhaust ports. Hemispherical combustion chamber in each cylinder head. One sparking-plug per cylinder, for starting only, energised by Napier high-energy ignition system. Cylinder blocks secured by twenty-four through-bolts which also assist in joining the two halves of the crankcase.

Combustion.—Centrally-located fuel injector in each cylinder combustion chamber, each injector having one central spray orifice and five equally-spaced radial orifices. Two six-element injection pumps on port and starboard flange positions on top of crankcase. Inlet air ducted from compressor, exhaust to turbine.

Pistons.—Two-piece pistons comprising Y-alloy body and austenitic steel head, latter carrying three gas rings.

Connecting Rods.—I-type rods, of 2½% nickel-chrome-molybdenum alloy steel, in pairs for each pair of opposed cylinders. Half, or slipper type, big and small-end bearings. Each pair of big-end half bearings retained on crankpin by straps. Small-end half bearings bear on curved pads secured in piston by four bolts and are retained by flanged cheek-plates.

Crankshaft.—Six-throw nitrided steel shaft carried in Vandervell thin-wall type lead-bronze bearings.

Crankcase.—Two-piece case of RZ-5 magnesium-zirconium alloy split on vertical centre-line. Bolted together at upper and lower flanges and additionally by the twenty-four through-bolts securing the cylinder blocks.

Turbine Compressor.

Compressor.—Twelve-stage axial-flow compressor with forward-facing intake. First five stages of rotor and stator blades of steel, remaining stages of aluminium-bronze. Automatically-controlled adjustable inlet guide-vanes. Compressed air trunked to inlet ports of diesel engine section. Compressor suspended below crankcase by four flexible links. Maximum pressure ratio 8.25 : 1. Mass air flow 13 lb. (5.9 kg.) per second.

Turbine.—Three-stage axial-flow turbine mounted co-axially with compressor. Turbine attached to rear gear casing by tubular framework and both turbine and compressor are interconnected through lowest member of reduction gear train by shafts having internally-toothed couplings at each end.

General.

Rear Gear Casing.—Machined from a magnesium-zirconium casting and contains main portion of reduction gear train between turbine and diesel engine. Also houses oil sump, oil pressure and scavenge pumps, coolant pumps and contains drives for engine starter and auxiliary gear-box.

Infinitely Variable Gear.—In housing attached to rear face of rear gear casing. Constant-mesh gear consists of a 'pack' of discs with narrow conical rims which are mounted on central shaft and are spring-loaded to trap a series of coned discs carried on three planetary shafts disposed around the central shaft. Each planetary shaft swings around a fulcrum to obtain changes in gear ratio. Gear lubricated by high pressure oil directed at contact points between each flanged and coned disc, power being transmitted through drag force obtained by fluid shear of oil film. Speed-reducing gear between turbine and diesel engine units of epicyclic type, the variable speed device being connected across two members of the epicyclic gear train. Two flexible drive shafts transmit turbine power to airscrew reduction gear-box at front of engine.

Control.—Single-lever control relates speed, boost and fuel functions together. Speed control provided by mechanically set constant-speed unit varying propeller pitch. For each speed selected there is a fixed value for boost pressure and for fuel flow. Boost pressure obtained is applied to normal type of variable-datum boost-control unit, servo piston of which is connected by linkage with control setting of variable gear. By this means gear ratio is automatically adjusted to speed-up compressor to maintain boost pressure with increasing altitude until maximum r.p.m. of turbo-compressor set is reached. This corresponds to maximum power altitude for that particular engine condition and above this point fuel flow is reduced automatically by re-setting device in sympathy with falling boost.

Starting.—112-volt electric starter geared with crankshaft system.

Fuel.—Wide-cut gasoline (D.Eng.R.D.2486) or Kerosene (D.Eng.R.D.2482) or Diesel fuel.

Propeller.—Rotol or de Havilland 13 ft. to 16 ft. (3.96 to 4.88 m.) diameter.

Reduction Gear Ratios.—0.526, 0.555, 0.569, 0.614, or 0.660 : 1

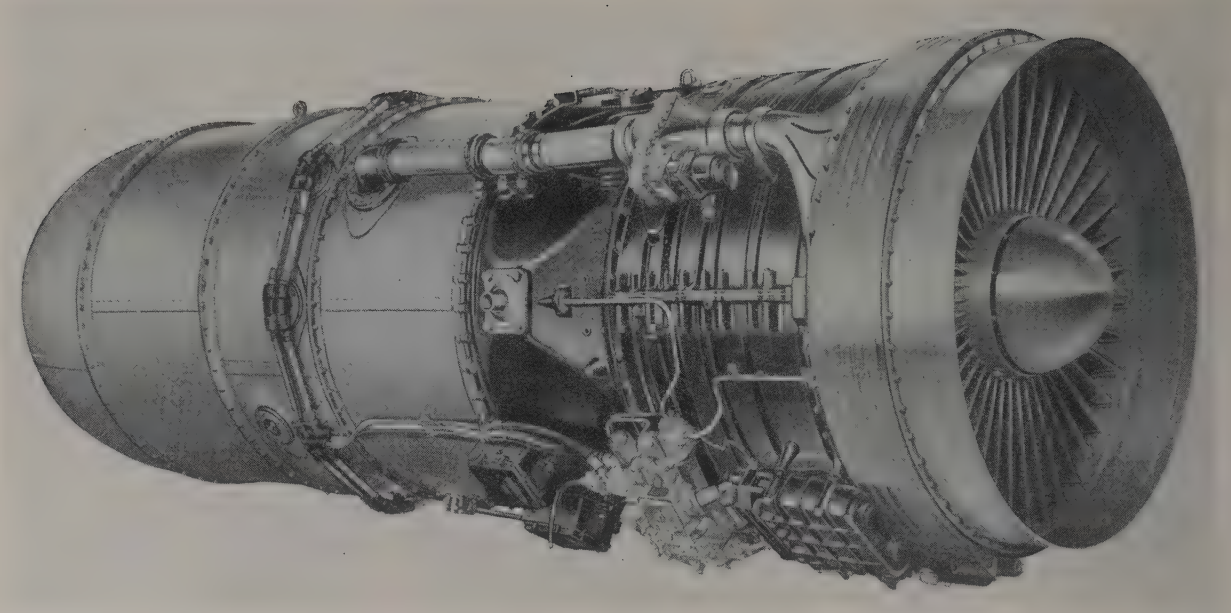
Dimensions.—
Overall length 119¼ in. (3,030 mm.).
Overall width 56¼ in. (1,428 mm.).
Overall height 40 in. (1,016 mm.).

Weight.—Net dry 3,580 lb. (1,625 kg.).

Performance Ratings (at sea level).—
Take-off 3,046 s.h.p. (3,135 e.h.p.) at 2,050 r.p.m.
Max. continuous 2,392 s.h.p. (2,448 e.h.p.) at 1,900 r.p.m.
Cruising 1,849 s.h.p. (1,893 e.h.p.) at 1,750 r.p.m.

Performance Ratings (at altitude—ICAN atmosphere—300 kts. = 555 km.h. T.A.S.).—
Max. continuous at 19,000 ft. (5,795 m.) 2,480 s.h.p. (2,584 e.h.p.) at 1,900 r.p.m.
Cruising at 25,000 ft. (7,625 m.) 1,952 s.h.p. (2,024 e.h.p.) at 1,750 r.p.m.

Fuel Consumptions.—
At take-off at S/L. 0.355 lb. (0.161 kg.) per s.h.p./hr.
At max. continuous at 19,000 ft. (5,795 m.) 0.346 lb. (0.157 kg.) per s.h.p./hr.
At cruising at 25,000 ft. (7,625 m.) 0.340 lb. (0.154 kg.) per s.h.p./hr.



The Rolls-Royce Conway "by pass" turbojet engine which has an initial rating of 13,000 lb. (5,900 kg.) s.t.

ROLLS-ROYCE, LTD.

HEAD OFFICE: DERBY.

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LONDON OFFICE: 14-15, CONDUIT STREET, W.1.

Established: March 15, 1906.

Directors: Lord Hives, C.H., M.B.E., Ll.D., D.Sc. (Executive Chairman); Lord Kindersley, C.B.E., M.C. (Deputy Chairman); Whitney W. Straight, C.B.E., M.C., D.F.C., (Executive Vice-Chairman); Harold Peake, M.A.; W. T. Gill, C.A.; The Hon. Maurice F. P. Lubbock; Dr. F. Llewellyn Smith, M.Sc., D.Phil. (Managing Director, Motor Car Division); J. D. Pearson, Wh.Sc., B.Sc. (Managing Director, Aero Engine Division); W. A. Robotham (General Manager, Oil Engine Division); A. A. Rubbra; A. F. Kelley.

At the end of 1941, under instructions from the Ministry of Aircraft Production, Rolls-Royce undertook the development and manufacture of the Whittle-type engine in conjunction with Power Jets, Ltd. and the Rover Company.

The first Rolls-Royce version of the Whittle W2B/23 jet-propulsion engine passed its 100-hour type test in April, 1943. It gave a thrust of 1,700 lb. (772 kg.) for a weight of 850 lb. (386 kg.). It was named the Welland, being the first of the Rolls-Royce "River" class of jet-propulsion engines, this name being chosen to give the idea of flow associated with jet-propulsion. Production deliveries of the Welland to the R.A.F. began in May, 1944, when this engine also passed its first 500-hour type test and went into service with 180 hours between overhauls.

In March, 1942, the Rover Company ran its prototype W2B/26 engine which was based on a Power Jet's design for a "direct-flow" combustion engine. The development of this engine was pursued by the Rover Company until Rolls-Royce took over the Rover factory at Barnoldswick in April, 1943. The W2B/26 served as the prototype for the Derwent 1 and the first Rolls-Royce engine of this type, completed in three and a half months, was on test in July, 1943. This engine was intended as a replacement for the Welland engine in the Gloster Meteor twin-jet fighter. The Meteor first flew with two Series 1 Derwent engines in March, 1944, each unit developing a thrust of 2,000 lb. (907 kg.) for a weight of 920 lb. (418 kg.). The current Derwent Series 8 engine which powers the Meteor 8 is rated at 3,600 lb. (1,635 kg.).

The Nene, a parallel development of the Derwent which it resembles in general features and layout, was designed and built in 5½ months and was first run in October, 1944. Designed for a static thrust of 4,000 lb. (1,814 kg.) at 12,300 r.p.m., performance was later improved and cleared for flight at 5,000 lb. (2,268 kg.) at 12,300 r.p.m.

The Avon engine, the first Rolls-Royce axial-flow engine to go into production, is being manufactured by the Rolls-Royce group of factories, as well as by D. Napier & Son, Ltd., and The Standard Motor Company, Ltd. It is also being manufactured under licence in Australia, Belgium, France and Sweden.

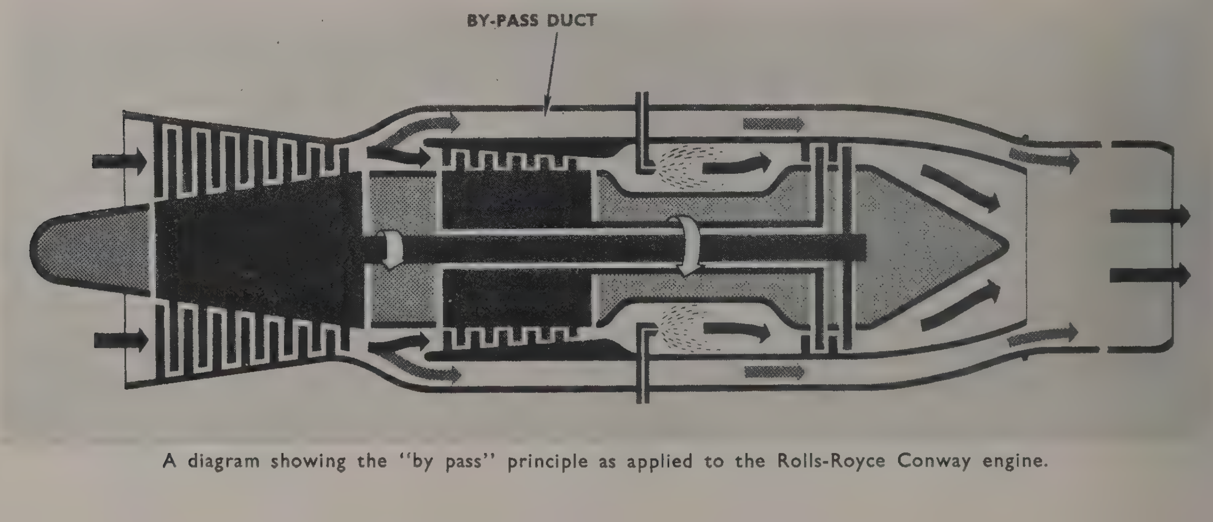
The Tay engine, designed by Rolls-Royce, has been jointly developed by Rolls-Royce and Pratt & Whitney. A development of the Nene, the rated thrust of the Tay is 6,250 lb. (2,840 kg.). The Tay is being built under licence in the U.S.A. by Pratt & Whitney under the designation J-48, and also in France by Hispano-Suiza.

The Nene is also manufactured under licence in Australia, and the Derwent in Belgium.

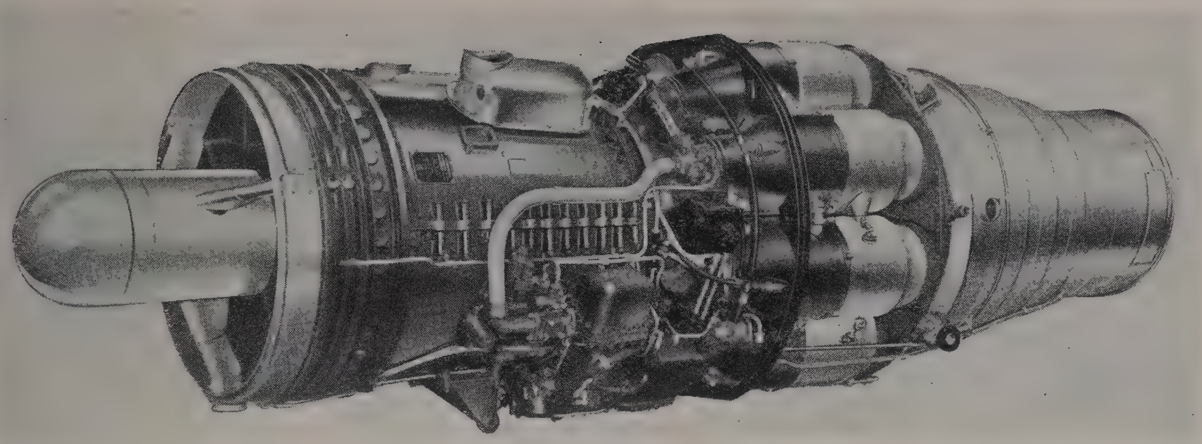
Four Rolls-Royce Dart turboprop engines form the power-plant of the Vickers Viscount which was the World's first turboprop-powered airliner to go into regular service.

THE ROLLS-ROYCE CONWAY.

The Conway is an axial-flow engine of the "by-pass" type. The "by-pass" engine resembles the normal jet engine but has an additional duct through which some of the air from the compressor



A diagram showing the "by pass" principle as applied to the Rolls-Royce Conway engine.



The Rolls-Royce Avon RA.7 axial-flow turbojet engine (7,500 lb. (3,402 kg.) s.t. at sea level).

by-passes the combustion chambers and re-enters the jet stream aft of the turbine.

The advantage of this type of engine over the straight-through jet is that although the by-pass engine works at a high pressure ratio, giving high internal efficiency, it also produces by means of the by-pass a final jet containing a greater mass of air moving at a lower speed, which gives a higher propulsive efficiency. The result of this arrangement is to improve the specific fuel consumption, thus making the engine particularly suitable for future large long-range civil airliners.

The lower jet velocity in conjunction with the latest form of Rolls-Royce jet nozzle will help to reduce jet noise, one of the most serious problems in civil aviation to-day. Installation and fire protection are also assisted by the duct of cool air which surrounds the hot part of the engine.

The Conway has completed an official type-test at 13,000 lb. (5,900 kg.) static thrust.

THE ROLLS-ROYCE AVON.

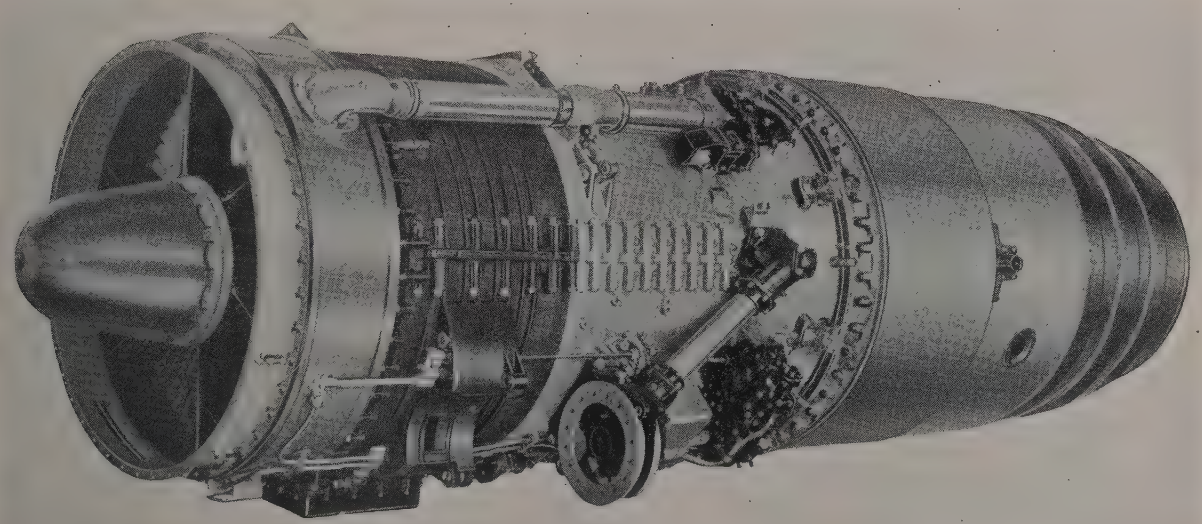
The Avon is an axial-flow engine of which only a few details are available for publication. It is in large-scale production in several versions for many types of installations in bombers, fighters and in civil aircraft. The following are the variants of which mention is permitted :—

RA.3 Basic S/L. s.t. rating 6,500 lb. (2,950 kg.). Production began in June, 1950.

RA.7. Basic S/L. s.t. rating 7,500 lb. (3,405 kg.). Type-tested in March, 1952.

ROLLS-ROYCE AVON AXIAL-FLOW TURBOJET ENGINES.

Type and Mark Number	Thrust (Basic S/L. rating)	Specific Fuel Consumption (max. T.O. conditions)	Net Dry Weight (approx.)	Length (without jet pipe)	Diameter
RA.3	6,500 lb. (2,950 kg.)	0.88 lb./hr./lb. (0.88 kg./hr./kg.)	2,240 lb. (1,016 kg.)	102.1 in. (2,593 mm.)	42.225 in. (1,072 mm.)
R.A.7	7,500 lb. (3,402 kg.)	0.92 lb./hr./lb. (0.92 kg./hr./kg.)	2,460 lb. (1,116 kg.)	102.1 in. (2,593 mm.)	42.225 in. (1,072 mm.)
RA.7R	9,500 lb. (4,310 kg.) (with reheat)	1.90 lb./hr./lb. (1.90 kg./hr./kg.) (with reheat)	2,960 lb. (1,343 kg.) (with reheat jet pipe)	117.5 in. (2,984 mm.)	42.225 in. (1,072 mm.)
RA.14	9,500 lb. (4,310 kg.)	0.84 lb./hr./lb. (0.84 kg./hr./kg.)	2,860 lb. (1,297 kg.)	113.3 in. (2,877 mm.)	41.5 in. (1,054 mm.)
RA.21	8,000 lb. (3,628 kg.)	0.925 lb./hr./lb. (0.925 kg./hr./kg.)	2,460 lb. (1,116 kg.)	102.1 in. (2,593 mm.)	42.225 in. (1,072 mm.)
RA.25 (Civil—Mk. 503)	7,000 lb. (3,175 kg.)	0.91 lb./hr./lb. (0.91 kg./hr./kg.)	2,440 lb. (1,107 kg.)	102.6 in. (2,606 mm.)	42.225 in. (1,072 mm.)
RA.26 (Civil—Mk. 521)	10,000 lb. (4,535 kg.)	0.83 lb./hr./lb. (0.83 kg./hr./kg.)	2,790 lb. (1,265 kg.)	113.3 in. (2,877 mm.)	41.5 in. (1,054 mm.)
RA.28	10,000 lb. (4,535 kg.)	0.86 lb./hr./lb. (0.86 kg./hr./kg.)	2,900 lb. (1,315 kg.)	113.3 in. (2,877 mm.)	41.5 in. (1,054 mm.)



The Rolls-Royce Avon RA.14 axial-flow turbojet engine which shows a change in combustor design as compared with the RA.7 above.

Thermal anti-icing. Seven versions of RA.7 rating engine in production. First deliveries to aircraft manufacturers in September, 1952. Built under licence in Australia, etc.

RA.7R. RA.7 with re-heat. Type-tested in January, 1953 at 9,450 lb. (4,290 kg.) S/L. static thrust with re-heat. Variable-area jet-pipe nozzle.

RA.14. Type-tested in April, 1953, at a thrust of 9,500 lb. (4,310 kg.) without re-heat. Since then the engine has been continuously and progressively developed in flight to give powers well into five figures. For fighter installation the RA-14 will be fitted with re-heat, or after-burning. Production and delivery of the RA.14 began only twenty months after the running of the first engine.

RA.21. RA.7 type up-rated to 8,000 lb. (3,632 kg.) s.t. See details in Table.

RA.26 (Mk. 521). Civil version of RA.28. 10,000 lb. (4,540 kg.) s.t. Weight 2,790 lb. (1,267 kg.). Powers the Comet Series 3.

RA.28. First Avon to be type-tested at 10,000 lb. (4,540 kg.) s.t.

RA.29. Civil engine rated at 10,200 lb. (4,630 kg.). To power the Comet Series 4.

Except for the information in the table on page 341 no other details of the Avon are available for publication.

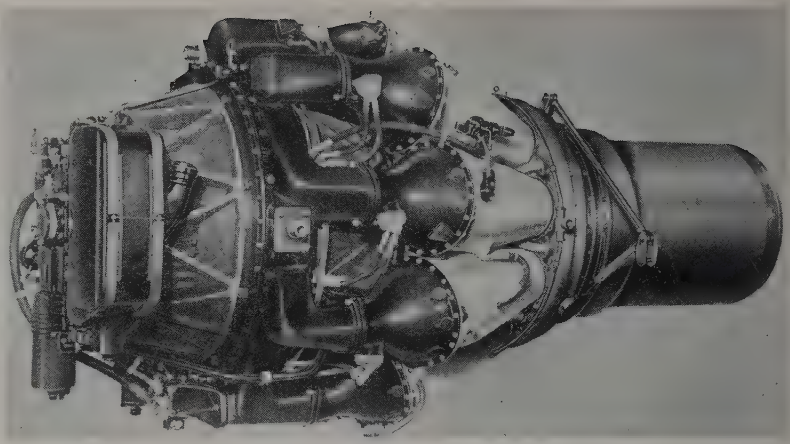
THE ROLLS-ROYCE DERWENT.

Type.—Centrifugal-flow Turbojet with single-stage double-entry compressor and single-stage turbine.

Compressor.—Single-stage double-entry centrifugal compressor with double-sided impeller 24.5 in. (525 mm.) in diameter. An 18-vane diffuser has a throat area of 56.8 sq. in. (245 cm.^{2}). Compression ratio 4.19 : 1 static, at take-off. Rotor assembly supported on three bearings.

Combustion Chambers.—Nine straight-flow combustion chambers with internal concentrically-mounted flame tubes. Interconnectors between the chambers to equalise pressure and to ignite the fuel in adjoining tubes when starting up. Two torch igniters (Mk. 8) or high-energy igniter plugs (in chambers 3 and 8).

Fuel System.—Engine-driven positive-displacement multi-plunger swashplate pump, with built-in overspeed governor, draws fuel through a fabric-element low-pressure filter and delivers it to fixed orifice type burners, one in each combustion chamber, via a throttle control valve and ring manifold. Pump delivery pressure is variable and is controlled by a built-in servo system actuated by a separate barometric pressure control containing a capsule which is subjected to nacelle pressure.



The Rolls-Royce Derwent 8 turbojet engine.

Fuel.—Aviation Turbofuel (D.Eng.R.D. 2482).

Turbine.—Single-stage axial-flow turbine with 54 blades. Direction of rotation anti-clockwise (viewed from rear).

Accessories.—Engine accessories, including fuel and oil pumps, mounted on wheelcase at front of engine, together with an electric starter motor. Drive provided in wheel-case for accessory gear-box.

Lubrication System.—Oil tank (22 pints = 12.5 litres capacity) mounted on engine wheelcase. A gear-pump supplies pressure oil to main bearings and wheel-case. Front bearings drain into wheel-case, which is scavenged by upper unit of a twin gear-type scavenge pump. Lower unit scavenges directly the centre and rear main bearings. Combined delivery from twin scavenge pump is discharged into the tank. No oil cooler fitted.

Oil Specification.—D.Eng.R.D.2490.

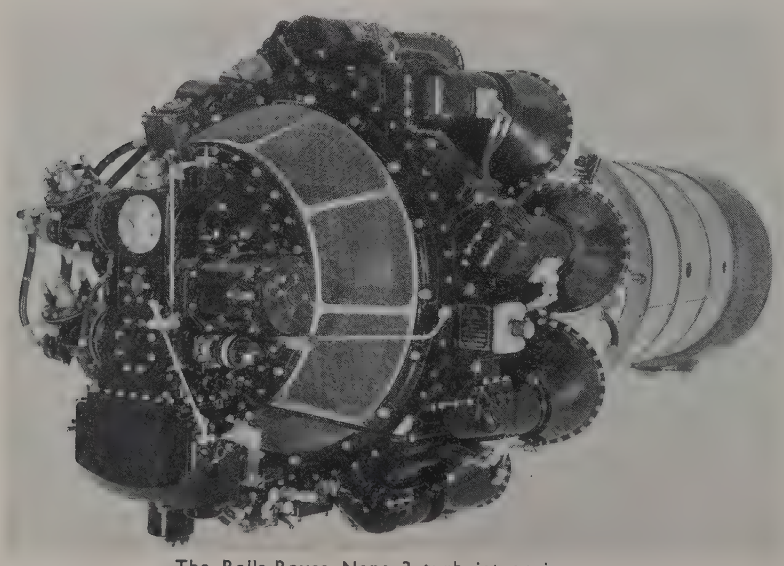
Mounting.—Two trunnions mounted on horizontal centre-line of the compressor casing, and a torsionally-free diamond frame with link connected and two aircraft pick-up points located 40 in. (1,016 mm.) aft of two main trunnions.

Dimensions.—
- Max. diameter 43 in. (1,092 mm.).
- Overall length 83.1 in. (2,108 mm.).
- Frontal area 10.1 sq. ft. (0.94 m.^{2}).

Weight Dry (including oil tank).—
1,280 lb. (580 kg.) approx.

Performance.—
- Take-off rating 3,600 lb. (1,633 kg.) thrust at 14,700 r.p.m. at sea level.
- Max. continuous rating 3,090 lb. (1,402 kg.) thrust at 14,100 r.p.m. at sea level.

Consumptions.—
- Fuel consumption (cruising) 1.03 lb./lb. thrust/hr. (1.03 kg./kg. thrust/hr.).
- Oil consumption 1 pint (0.56 litres) per hour max.



The Rolls-Royce Nene 3 turbojet engine.

THE ROLLS-ROYCE NENE.

Several versions of the basic Nene engine are now in service, the main differences between which are as follows:—

Mk. 3. Electric starter motor and two torch igniter units. Powers the Supermarine Attacker F. Mk. 1.

Mk. 10. Similar to Mk. 102 but a larger wheelcase is provided to mount and drive aircraft accessories. Engine adapted for installation in Canadair Silver Star (Lockheed T-33) trainer.

Mk. 101. Fitted with front panel of plenum chamber, horizontal gearbox drive, Plessey turbo-starter and two high-energy igniters and a divided jet pipe. This last-mentioned item has the effect of lowering the thrust by a 100 lb. (45.4 kg.) to 5,000 lb. (2,266 kg.). Powers the Hawker Sea Hawk.

Mk. 102. Installationally similar to the Mk. 3 but incorporating latest detail design changes. Electric starter motor and two high energy igniters. Powers the Supermarine Attacker F.B. Mk. 2.

The description and specification given below are applicable generally to all marks.

Type.—Centrifugal-flow turbojet with single-stage double-entry compressor and single-stage turbine.

Compressor.—Single-stage double-entry centrifugal compressor with double-sided impeller. Impeller has 29 vanes per side with separate forged aluminium rotating guide vanes machined all over. Compression ratio (static) 4 : 1. Rotor assembly, consisting of impeller, turbine and shafts, supported on three bearings. End bearings of roller type and centre bearing a deep-grooved ball bearing. Mounted on shaft between compressor and centre bearing is a fan which directs cooling air on to and under centre and rear bearings and face of turbine disc.

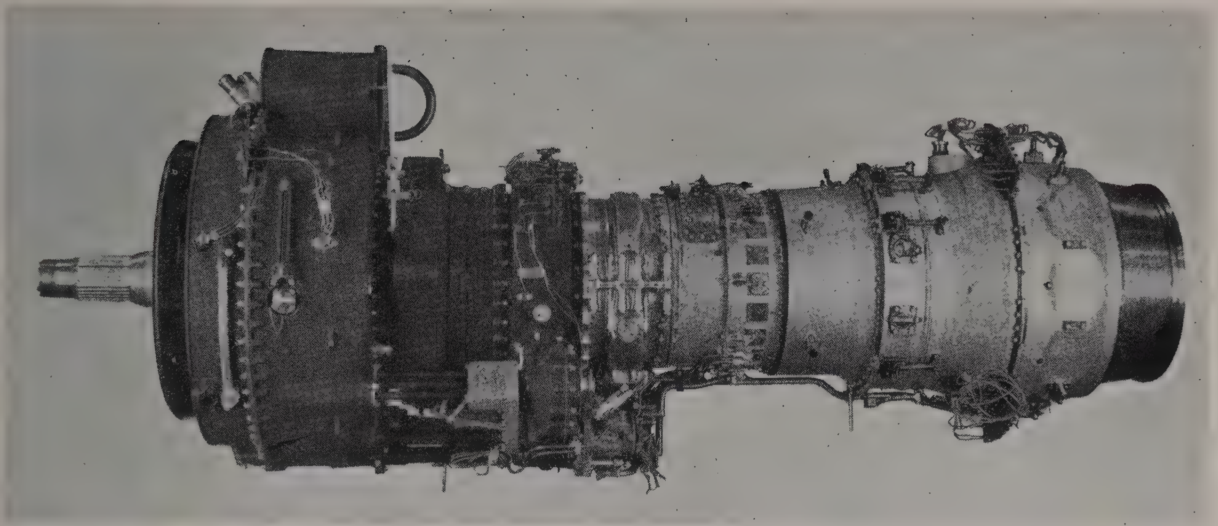
Combustion Chambers.—Nine straight-flow combustion chambers each consisting of an outer casing, a perforated flame tube and duplex burner. Flame igniters in Nos. 3 and 8 air casings.

Fuel System.—Twin pumps of oscillating multi-plunger type with built-in overspeed governors draw fuel through filter mounted under wheelcase and deliver to burners via throttle control valve, high-pressure shut-off cock and pressurising valve. Barometric pressure control acts on servo mechanism in high-pressure pump to vary pump delivery according to altitude requirements. Acceleration control unit retards fuel flow to prevent over-fuelling during acceleration periods.

Fuel.—Aviation Turbofuel (D.Eng.R.D.2482).

Turbine.—Single-stage axial flow turbine comprising solid steel disc and 54 blades in Nimonic 80 nickel chromium alloy. Blades secured in periphery of turbine disc by "fir-tree" type serrated roots. Wheel and shaft bolted together. Jet pipe temperature 690°C. approx.

Jet Pipe.—Consists of jet pipe and propelling nozzle. Exhaust cone of fixed length but jet pipe varies in length according to



The Rolls-Royce RB.109 turbojet engine (4,000 s.h.p. plus 1,000 lb. (454 kg.) jet thrust.)

installation requirements of aircraft. These parts mainly double-walled, with space between packed with Alfol heat-insulating material. Air heating jackets can be arranged around jet pipe for gun or cabin heating.

Accessory Drives.—Wheelcase on front of engine, driven from forward impeller shaft, houses drives for aircraft accessory gear-box, tachometer generator and two fuel-pumps. Alternative drive positions for aircraft accessory gear-box, upper horizontal drive and upward inclined drive, suiting Rotol S.G.1 series of gear-boxes. Speed of gear-box drives 0.421 engine speed. Cabin supercharger driven from accessory gear-box. 24-volt electric starter motor mounted on port side of wheelcase.

Lubrication System.—Continuous circulation system, with main bulk of oil contained in sump mounted on lower part of wheel case. Sump houses pressure and scavenge oil-pumps, two gauze scavenge oil filters. Puralotor high-pressure filter, pressure relief valve and de-aerator. Capacity of oil sump approx. 9 pints (5.7 litres). Specification DEF.2001 oil is used.

Mounting.—Range of standardised brackets designed to suit various types of installation with six alternative combinations of attachment points.

Dimensions.—
- Max. diameter 49.5 in. (1,258 mm.).
- Overall length to exhaust cone flange 96.8 in. (2,960 mm.).
- Length of jet pipe, to suit installation.
- Frontal area 13.4 sq. ft. (1.24 m.²).

Weight.—
- Dry (including auxiliaries but excluding aircraft accessories and jet pipe) 1,600 lb. (725 kg.) approx.

Performance.—
- Take-off and combat thrust rating 5,100 lb. (2,315 kg.) at 12,500 r.p.m. (static).
- Max. continuous power 4,090 lb. (1,815 kg.) thrust at 11,800 r.p.m. (static).

Consumptions (at max. T.O.).—
- Fuel consumption 1.06 lb./lb. thrust/hr. (1.06 kg./kg. thrust/hr.).
- Oil consumption 1 pint (0.56 litres) per hour (max.).

THE ROLLS-ROYCE TAY.

The Tay engine was designed by Rolls-Royce to meet the requirement for a centrifugal-flow gas-turbine of greater thrust than existing Rolls-Royce engines of this type. The engine has been intensiveley developed by Rolls-Royce and Pratt & Whitney. The joint work of the two companies resulted in the completion of official flight substantiation tests at the Pratt & Whitney plant of a Tay engine, having a basic power rating of 6,250 lb. (2,840 kg.) thrust.

The American development of this engine is now in production by Pratt & Whitney as the J48 Turbo-Wasp (which see). The Tay is also being built under licence in France by the Hispano-Suiza company.

THE ROLLS-ROYCE RB.109.

The RB.109 is a two-spool turboprop engine which has an initial power output of some 4,400 e.h.p. for a weight of under 1,900 lb. (862 kg.). The engine first ran in April, 1955, but no particulars were available for publication at the time of closing for press.

THE ROLLS-ROYCE DART.

There are three current versions of the Dart, the Mks. 505, 506 and 510. The Mk. 505 has torch igniters for starting, whereas the Mks. 506 and 510 high-energy igniter plugs.

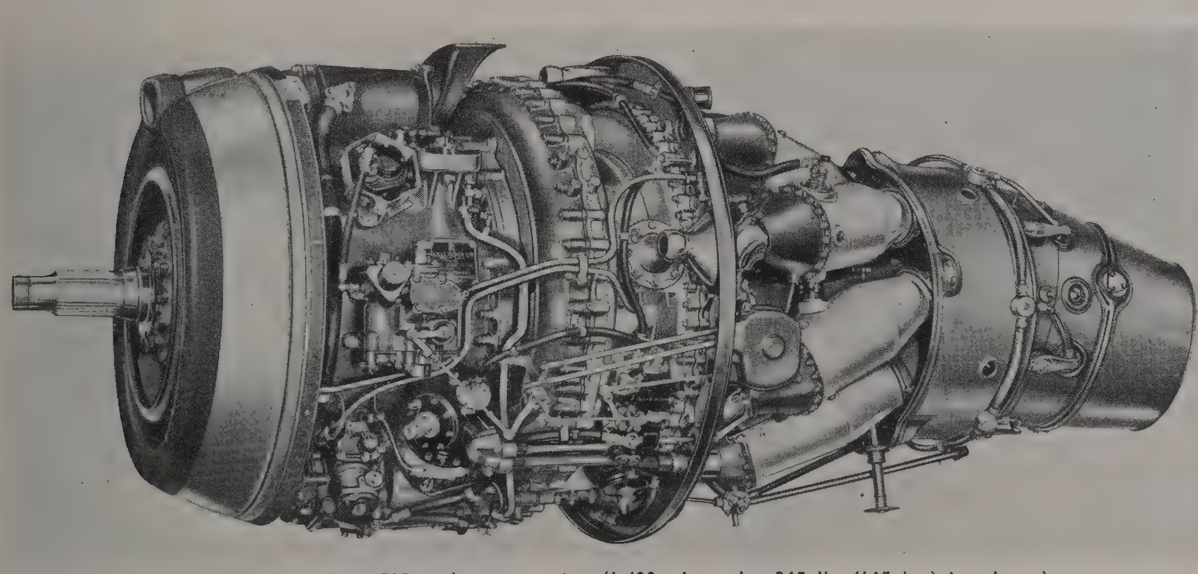
The Mk. 510 has a maximum output of 1,600 s.h.p. and a cruising rating of 1,285 s.h.p., as compared with 1,400 and 1,120 s.h.p. respectively for the Mks. 505 and 506.

Type.—Turboprop with two-stage centrifugal compressor and two-stage turbine.

Reduction Gear.—Double reduction gearing with helical high-speed train and final spur gear drive. The two gear trains connected by three layshafts. High-speed sun-wheel driven from forward end of impeller shaft with final drive through a large annulus splined to airscrew shaft. All gears and airscrew shaft carried in roller or ball bearings. Bevel gears from one of the layshafts provide drives to fuel and oil pumps and constant-speed unit. Bevel gear and engaging mechanism on sun-wheel shaft provide drive from starter motor. Reduction gear ratio 0.106 : 1 (505 and 506), 0.093 : 1 (510).

Air Intake.—Circular intake with annular duct leading to impeller eye of first-stage compressor. Oil tank around intake is cast integral with casing. Secondary air intake supplies air to oil cooler mounted on top of casing.

Compressor.—Two - stage centrifugal-flow



The Rolls-Royce Dart 505 turboprop engine (1,400 s.h.p. plus 365 lb. (165 kg.) jet thrust).

compressor. Each impeller has nineteen vanes and steel rotating guide vanes. Mass air flow at maximum r.p.m. 20 lb./sec. (9.1 kg./sec.) at 5.5 : 1.

Combustion Chambers.—Seven straight-flow combustion chambers. Flame tubes in Nimonic 75 with fuel atomisers in front end of each tube for downstream injection. Torch igniters (Mk. 505) or high-energy igniter plugs (Mks. 506 and 510) in Nos. 3 and 7 chambers.

Fuel System.—Single multi-plunger variable-stroke injection pump delivers fuel to burners and torch igniters (when fitted) through flow control unit, which incorporates a filter, throttle valve, shut-off cock and barometric pressure control solenoid. Operation of control unit is function of intake pressure and throttle valve pressure drop, thus determining fuel/air ratio for all engine operating conditions. Fuel pressure at burners varies from 40 lb./sq. in. (2.81 kg./cm.²) at idling speed to 920 lb./sq. in. (64.6 kg./cm.²) at maximum power. Automatically-progressive injection of water/methanol used to restore take-off power under high ambient temperature conditions. System inter-connected mechanically with throttle lever to ensure that it can only be used at take-off r.p.m. Fuel filter de-icing by hot air from compressor. Hot-air gate fitted to bottom engine mounting.

Turbine.—Two-stage axial-flow turbine, the two discs coupled and bolted to a single shaft which forms direct drive to compressor. First-stage turbine disc in Jessops G18B steel, second-stage disc in S.62 stainless steel. 131 blades on first stage turbine, 103 on second-stage. All blades of Nimonic alloy, and secured on discs by "fir-tree" type serrated roots. Each turbine wheel cooled on both faces by air bled from compressor.

Exhaust Unit.—Airscrew thrust line co-axial with engine main shaft but exhaust unit can be either straight or have a slight inclination to suit installation. Unit comprises an outer shell which supports an inner cone on three struts enclosed in aerofoil-section fairings to reduce turbulence and straighten gas flow at nozzle.

Accessory Drives.—An accessory gear-box drive is taken from the main-shaft centre-coupling immediately behind compressor through a train of gears, to a housing on top of intermediate casing; a universal coupling provides final drive to gear-box.

Lubrication.—Entirely self-contained. Integral oil tank (total capacity 25 pints=14 litres) has two compartments, one for engine requirements and other for airscrew feathering. Gear pump supplies oil to all bearings and reduction-gear jets at nominal pressure of 30 lb./sq. in. (2.10 kg./cm.²) and at nominal flow of 460 Imp. gallons (2,091 litres) per hour. Combined delivery from four scavenge pumps returned to tank *via* oil-cooler on top of intake casing. Pressure and scavenge pumps in single housing and driven by common shaft.

Controls.—Only two cockpit controls, a throttle lever for varying power and a high-pressure cock for stopping engine. Throttle valve is interconnected with the airscrew controller and high-pressure cock is linked with airscrew feathering controls. Blades may be feathered by moving shut-off cock lever past the closed position; depression of an unfeathering button returns blades to fine pitch. To avoid undue load when starting, a cut-out connected with the airscrew prevents engine starting system from operating unless blades are in zero pitch. Safety device prevents airscrew from going into zero pitch unless aircraft weight is on landing-gear.

Mounting.—Four feet are provided at 90° on the horizontal and vertical centre-lines of compressor casing, although only three need be used. Bottom foot for hot-air gate valve. No rear mounting is required, but jet pipe if used requires separate mounting in airframe.

Dimensions.—
- Length to exhaust cone 95.125 in. (2.416 mm.).
- Diameter over cowling 37.9 in. (963 mm.).
- Frontal area 7.9 sq. ft. (0.734 m.²).

Weights (Dry).—
- Mk. 505—1,030 lb. (468 kg.), Mk. 506—1,144 lb. (519 kg.), Mk. 510—1,110 lb. (504 kg.).

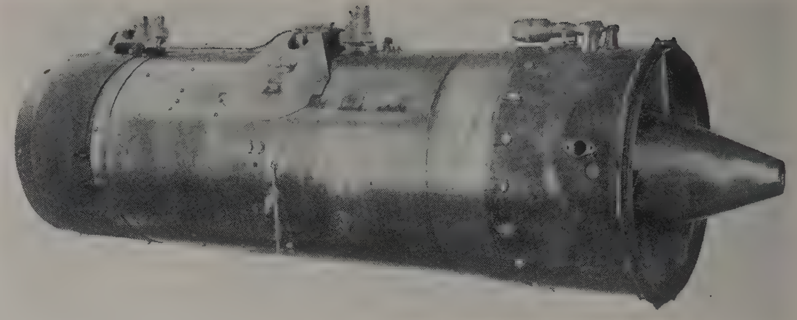
Performance (Mks. 505 and 506).—
- Max. take-off (static) 1,400 s.h.p. plus 365 lb. (165 kg.) jet thrust at 14,500 r.p.m.
- Max. continuous cruising rating (static) 1,120 s.h.p. plus 295 lb. (134 kg.) jet thrust at 13,800 r.p.m.

Performance (Mk. 510).—
- Max. take-off (static) 1,600 s.h.p. plus 370 lb. (168 kg.) jet thrust at 14,500 r.p.m.
- Max. continuous cruising rating (static) 1,285 s.h.p. plus 300 lb. (136 kg.) jet thrust at 13,800 r.p.m.

Fuel Consumptions (Mk. 505).—
- At max. take-off (static) 1,165 lb. (529 kg.) per hour, at max. continuous cruise (static) 1,008 lb. (458 kg.) per hour.

Fuel Consumptions (Mk. 506).—
- At max. take-off (static) 1,120 lb. (508.5 kg.) per hour, at max. continuous cruise (static) 968 lb. (439.5 kg.) per hour.

Fuel Consumption (Mk. 510).—
- At max. take-off (static) 1,200 lb. (545 kg.) per hour; at max. continuous cruise (static) 1,028 lb. (467 kg.) per hour.



The Rolls-Royce Soar lightweight turbojet engine.

THE ROLLS-ROYCE SOAR.

The Soar is a small axial-flow turbojet engine of extremely simple construction and with a record specific weight of 0.148 lb. per pound of thrust. The Soar has been type-tested at 1,860 lb. (844 kg.) s.t. and is in production with a static thrust rating of 1,810 lb. (821 kg.).

No structural details of the Soar were available for publication at the time of writing, but its external appearance may be seen in the accompanying illustration.

Dimensions.—
- Overall diameter 15.8 in. (40 cm.).
- Length 58.95 in. (150 cm.) without air intake 77 in. (196 cm.) with air intake.

Net Dry Weight.—
- 267 lb. (121 kg.) without air intake, 275 lb. (125 kg.) with air intake.

Performance.—
- Max. static thrust 1,810 lb. (822 kg.).

Consumption.—
- Fuel 1.27 lb./lb. s.t./hr. (1.27 kg./kg. s.t./hr.).

SARO

SAUNDERS-ROE, LTD.

Head Office: Osborne, East Cowes, Isle of Wight.

Works: East Cowes, Isle of Wight, and Southampton Airport, Eastleigh, Hants.

Helicopter Division: Southampton Airport, Eastleigh, Hants.

President: Sir Alliott Verdon-Roe, O.B.E., Hon. F.R.Ae.S., M.I.Ae.E.

Directors: The Hon. H. N. Morgan-Grenville, O.B.E. (Chairman); Sir Arthur Gouge, B.S., F.R.Ae.S., M.I.Mech.E. (Vice-Chairman); Capt. E. D. Clarke, M.C. (Managing Director); W. Browning, F.R.Ae.S., A.M.I.Mech.E., M.I.P.E. (General Manager); H. Knowler, A.M. I.C.E., F.R.Ae.S. (Technical); R. V. Perfect (Sales); The Hon. M. F. P. Lubbock; M. D. N. Wyatt; and P. D. Irons, B.Com., A.C.A., F.C.W.A. (Secretary).

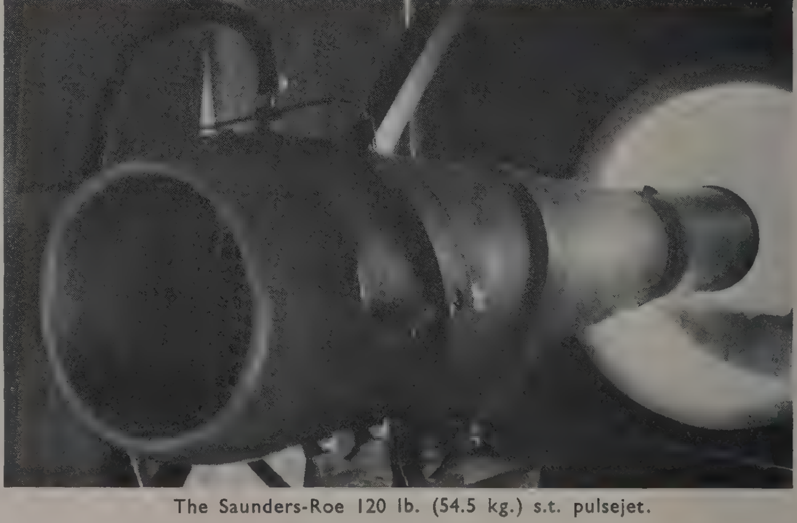
Saunders-Roe, Ltd. has been engaged since 1952 on the design and development of pulsejet engines for helicopter rotor propulsion and other applications.

Its first unit developed a maximum static thrust of 45 lb. (20.5 kg.) and weighed 15.5 lb. (7 kg.) and had a fuel consumption of 2 lb./lb. s.t./hr. (2 kg./kg. s.t./hr.) at 80 per cent. of its maximum thrust. Overall length is 47.5 in. (120 cm.) and the maximum diameter 5.5 in. (14 cm.).

The pulse jet consists of a near cylindrical combustion chamber open at one end and with a non-return type reed valve at the other.

Starting consists of jetting a blast of air into the valve, pressing an ignition switch and opening a fuel cock. Resonance at approximately 130 c.p.s. is immediate and the unit will continue to operate after the air jet and ignition circuits have been cut off. The thrust is varied *via* a throttle which controls the fuel supply. Throttle response is immediate and within a wide thrust range it is impossible to stall the unit.

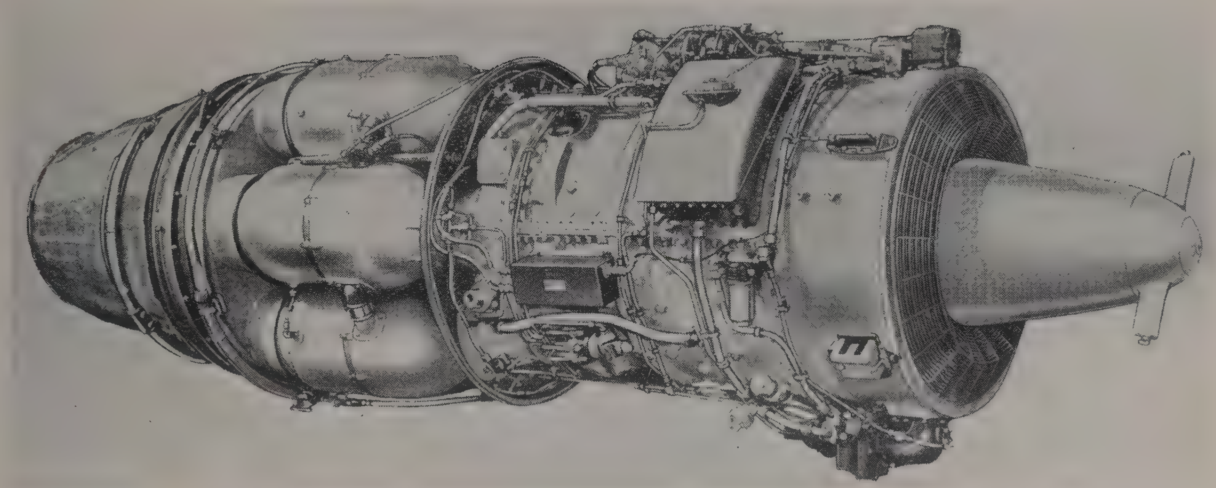
Development is proceeding with larger variations of the 45 lb. s.t. model and improved combustion techniques have shown that reduction in fuel consumption may be expected.



The Saunders-Roe 120 lb. (54.5 kg.) s.t. pulsejet.

CANADA

ORENDA



The Orenda Series 9 axial-flow turbojet engine, which has a thrust rating of over 6,000 lb. (2,720 kg.).

ORENDA ENGINES, LIMITED.

Head Office and Works: Malton, Ontario.

Postal Address: Box 4015, Terminal "A", Toronto.

President and Chairman: Crawford Gordon, Jr.

Vice-President and General Manager: W. R. McLachlan.

Vice-President—Engineering and Chief Engineer: C. A. Grinyer.

Vice-President—Manufacturing: E. K. Brownridge.

Vice-President—Sales and Service: F. L. Trethewey.

Orenda Engines, Ltd., formerly the Gas Turbine Division of A. V. Roe Canada, Ltd., is the sole designer and producer of jet engines in Canada. Currently in production are the Orenda 11 and 14 turbojet engines for the CF-100 Mk. 4 and the Canadair Sabre Mk. 6 respectively.

The company's plant at Malton, Ontario, was officially opened in September, 1952. It was initially built and operated for the Canadian Government by A. V. Roe Canada, Ltd. but was bought together with certain other facilities by the company in July, 1953.

With the requirement that all possible sub-contracts for Orenda production be placed in Canada, an extensive sub-contracting industry has developed. Among the principal Orenda sub-contractors are Canadian Steel Improvement, Ltd., now also a member company, of A. V. Roe Canada (turbine blade forgings); Lucas-Rotax (Canada) Ltd. (fuel pumps); Cockshutt Aircraft, Ltd. (combustion chambers); Light Alloys, Ltd. (magnesium castings and forgings); McDonald Bros. Aircraft, Ltd. (jet-pipe and tailcone); York Gears, Ltd. (gearboxes); and Canadian SKF Co., Ltd. (bearings).

THE ORENDA.

The Orenda ran for the first time in February, 1949, and within 8½ months of the first run the prototype engine had completed 750 hours of development flying without a major rebuild or overhaul.

The Orenda engine first flew as prime mover in a North American F-86A at the Edwards A.F.B., Muroc, California, in October, 1950. On June 20, 1951, the Avro Canada CF.100 two-seat long-range all-weather interceptor fighter, for which the Orenda engine was specifically designed, made its first flight powered by two Orenda engines.

The Orenda is now in production. The following versions have been publicly announced:—

Orenda 1. Original design. First ran in February, 1949, thirty months after the design was initiated.

Orenda 2. First production version. Passed its type test in February, 1952. Essentially the Orenda 1 with modified suspension and reduced weight.

Orenda 3. An Orenda 1 modified for installation in a special F-86A. This was the first model to fly under its own power.

Orenda 8. Modified compressor to improve acceleration characteristics. Incorporates Bendix flow-control unit containing acceleration controller. Arrangement of accessories such that right and left-hand engines are required for the CF-100 installation. Passed type test in January, 1953.

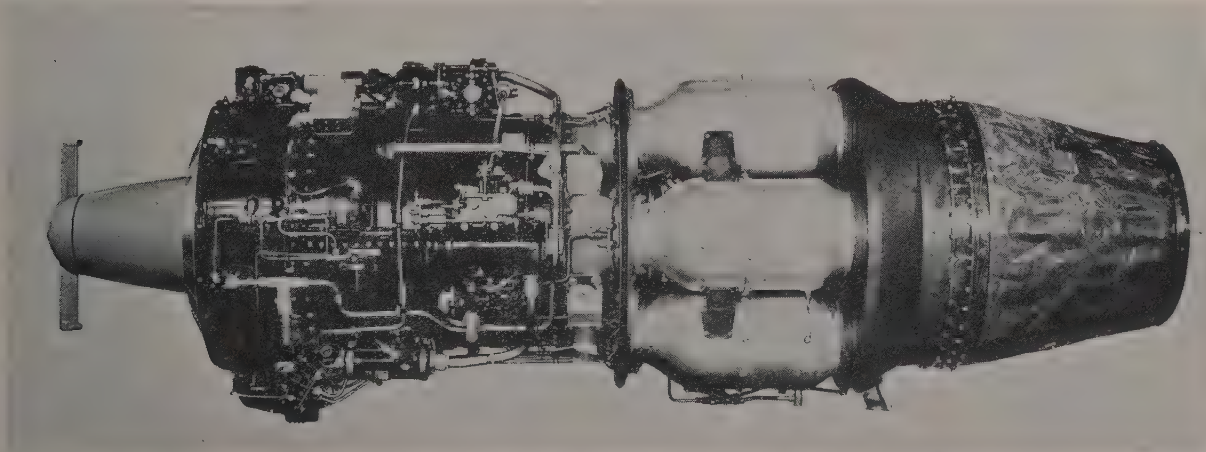
Orenda 9. Basically a left-hand Series 8 engine with minor external modifications so that the engine is suitable for installation in either right or left-hand nacelle of CF.100 Mk. 4. Incorporates alcohol anti-icing of engine intake.

Orenda 10. Basically an Orenda 8 engine with minor external modifications for installing in Canadair Sabre Mk. 5. Incorporates Delco starter-generator in nose bullet instead of Jack & Heintz electric starter in other models. Uses aircraft oil tank instead of integral engine oil supply as on all other models. As with all the above engines the Orenda 10 is in the 6,500 lb. (2,950 kg.) static thrust category.

Orenda 11. A two-stage development of Orenda 9. Has high-energy ignition. Develops over 7,000 lb. (3,170 kg.) s.t. at 7,800 r.p.m. Type-tested in January, 1954.

Orenda 14. Similar to Orenda 11 but adapted for installation in Canadair Sabre Mk. 6. Same rating as Orenda 11. Type-tested in September, 1954.

The description which follows applies specifically to the Orenda Series 9 although the general structural description may be taken to cover all versions.



The Orenda Series II engine, a higher-powered development of the Series 9 with a two-stage turbine.

Type.—Axial-flow turbojet.
Air Intake.—Annular intake surrounding nose bullet. Intake frame houses power take-off, supports electric starter and provides for attachment of debris guard and intake fairing. Radial struts of frame carry starter leads and various other engine services.
Compressor.—Ten-stage axial-flow compressor made up of blade discs mounted on internal drum. Pads on an annular duct at 8th stage are available for air bleed for aircraft services.
Combustion Chambers. — Six interconnected straight-through chambers each with a concentrically-mounted flame tube having a burner in the front end and discharging down-stream. Interconnectors between Nos. 1 and 2 and Nos. 5 and 6 chambers each carry torch igniter atomiser and igniter plug.
Fuel System.—Fuel delivered by two Lucas high-pressure pumps through Bendix flow control unit, which embodies the air/fuel ratio controller, and a Lucas flow distributor valve. Lucas Duplex III burners.
Fuel.—3-GP-23A (MIL-F-5616 Grade JP-1) or 3-GP-22A (MIL-F-5624A Grade JP-4).
Turbine.—Single-stage turbine consisting of an austenitic steel disc with nickel-chromium blades inserted in its periphery by "fir-tree" fixings. Centre and rear bearings and both faces of turbine disc cooled by compressor air bled from second and fifth stages and by leakage air from tenth stage peripheral seal.
Jet Pipe.—Fabricated from 321 stainless steel sheet with stainless steel flanges at front and rear. Bullet supported by four tubular struts which pass through four large straightener vanes. Outer jet-pipe casing lagged with insulation blanket.
Accessory Drives.—From front end of compressor shaft through vertical shafts to bevel-drive gearbox above and oil pump gearbox below. Shaft from upper bevel drive operates auxiliary gear box which carries two fuel pumps and a tachometer generator. Connection provided on oil pump gearbox to drive shaft to a separate accessories gearbox mounted in the airframe.
Lubrication.—Dry sump type. Two Nichols oil pumps with total of one pressure and four scavenge elements. Pressure oil supplied to rotor bearings, gear boxes, front bearing seal and drive-shaft flexible coupling through ring main. Used oil collects in three separate sumps. Relatively cool oil from front sump is returned directly to tank while hot oil from two rear sumps returns to tank through cooler which uses engine fuel as coolant. Capacity of integral oil tank 17.3 Imp. pints. Maximum oil temperatures 70°C. (158°F.) at ring main, 140°C. (284°F.) at central bearing scavenge. Oil specification MIL-0-6081A Grade 1010.
Mounting.—Three-point suspension with two trunnions on centre casing and an adjustable strut on backbone ahead of turbine nozzle box.
Ignition.—Two GLA high-intensity igniter plugs and one Orenda torch igniter fed through solenoid-operated reducing valve from high-pressure fuel line.
Dimensions.—
Nominal diameter 42 in. (107 cm.).
Length of engine 121.5 in. (3,090 mm.).
Length overall 144.1 in. (3,660 mm.).
Weights.—
Dry 2,560 lb. (1,160 kg.).
Performance Rating.—
Static thrust over 6,000 lb. (2,720 kg.) at 7,800 r.p.m. at sea level..
Consumptions.—
Fuel 1.09 lb./lb. thrust/hr. (1.09 kg./kg. thrust/hr.).
Oil 2 pints/hr. max.

ROLLS-ROYCE

ROLLS ROYCE OF CANADA, LTD.

Head Office and Works: Côte de Liesse Road, near Montreal, P.Q.

Acting General Manager: R. M. Kendall.

Production Manager: David Boyd.

Rolls-Royce of Canada, Ltd. was formed in 1952 to undertake the assembly and manufacture of Rolls-Royce gas-turbine engines and to supply the necessary overhaul, technical service and spare parts for Rolls-Royce products in North America. The present company is the successor to Rolls-Royce Montreal, Ltd. which operated solely as a service organisation for Rolls-Royce engines in use in Canada.

Manufacture, overhaul and assembly of the Nene 10 turbojet engine is being currently undertaken in the factory at Montreal. Technical service and spare parts for the Merlin and Dart engines of Trans-Canada Air Lines are being provided from Montreal, and similar service is being provided for the Nene engines in the Royal Canadian Air Force and the Dart engines which power the Viscounts in service with Capital Air Lines (U.S.A.).

FRANCE

DASSAULT

AVIONS MARCEL DASSAULT.

Head Office: 46, Avenue Kléber, Paris (16e).

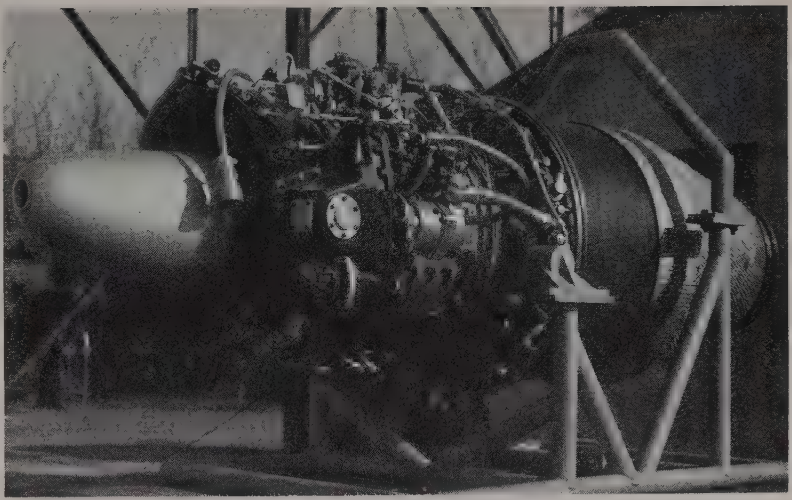
Works: Saint Cloud (Seine).

President: M. Marcel Dassault.

In 1953 Avions Marcel Dassault acquired the licence to build the Armstrong Siddeley "long-life" Viper turbojet engine in France. The licence-built engine carries the designation M.D. 30 Viper.

Dassault has undertaken considerable engineering work in adapting the Viper to certain specific requirements, including the development of an afterburner.

The first application of M.D. 30 to a French airframe was in the Sud-Ouest 9000 Trident turbojet/rocket powered research monoplane in which two Vipers are now installed at the wing tips. In this installation the two engines are "handed" with the accessories mounted on the inboard sides. With the power of its wing-tip-mounted Vipers only the Trident has exceeded Mach. 1 in a shallow dive. With rocket power only it has exceeded Mach. 1 in a climb. Vipers with afterburners are installed in the Sud-Ouest 9050 interceptor development of the Trident. Two M.D. 30 Vipers fitted with afterburners also power the Dassault M.D. 550 delta fighter.



The Dassault M.D. 30 Viper turbojet engine.

THE DASSAULT M.D. 30 VIPER.

The M.D. 30 turbojet has a seven-stage axial-flow compressor, an annular combustion chamber and a single-stage turbine. The compression ratio is 3.5 : 1 and the mass air-flow at 13,400 r.p.m. at sea level is 14 kg. (30.8 lb.) per second. A general description of the Viper will be found under "Armstrong Siddeley" (Great Britain).

Dimensions.—
- Diameter 580 mm. (23 in.).
- Length (without afterburner) 1,680 mm. (66 in.).
- Length (with afterburner) 3,200 mm. (126 in.).

Weight Dry.—
- Without afterburner 235 kg. (517 lb.).
- With afterburner 315 kg. (693 lb.).

Ratings.
- Take-off, without afterburner 745 kg (1,640 lb.) s.t. at 13,400 r.p.m.
- Take-off, with afterburner 1,000 kg. (2,200 lb.) s.t. at 13,400 r.p.m.

Consumptions.—
- Fuel (without afterburner) 1.09 kg./kg. s.t./hr. (1.09 lb./lb. s.t./hr.).
- Fuel (with afterburner 2.20 kg./kg. s.t. hr. (2.20 lb./lb. s.t./hr.).

HISPANO-SUIZA

SOCIÉTÉ D'EXPLOITATION DES MATÉRIALS HISPANO-SUIZA.

Head Office and Works: Rue du Capitaine Guynemer, Bois Colombes (Seine).

The Hispano-Suiza company entered the turbojet field by acquiring the licence to build the Rolls-Royce Nene and Tay engines. More recently the company has acquired a licence for the Rolls-Royce Avon axial-flow engine.

The first production engine was the Nene for installation in the S.N.C.A.S.E. Mistral and the Dassault Ouragan.

The Tay has since gone into production and this engine powers the Dassault Mystère II and Mystère IV. A Tay-engined Mystère II was the first French aircraft to exceed the speed of sound.

The Verdon, developed from the Tay in the same way that the Tay was evolved from the Nene, powers the Mystère IVA.

The Hispano Avon of RA.7 rating is installed in the Super Mystère IVB.1 prototype, and civil engines of RA.16 rating power the Sud-Est S.E. 210 Caravelle.

Hispano-Suiza has also undertaken considerable development work in both engines and afterburners.

THE HISPANO-SUIZA R.800.

The R.800 is a small axial-flow turbojet engine which has been designed to meet an official requirement for a power-plant suitable for lightweight fighter aircraft. Its basic designed rating is 1,200 kg. (2,640 lb.) s.t. With afterburner it is expected to develop a sea level static thrust of 2,000 kg. (4,400 lb.).

Dimensions.—
- Diameter 60 cm. (23.6 in.).
- Overall length with afterburner 200 cm. (78.7 in.).

Dry Weight.—
- Without afterburner 275 kg. (605 lb.).

THE HISPANO-SUIZA NENE.

The Hispano-Suiza Nene, built under a Rolls-Royce licence, exists in the following versions :—

Nene 102. Substantially similar to the Rolls-Royce Nene 102 but has an aluminium-alloy compressor casing. Weight 860 kg. (1,760 lb.).

Nene 104. Similar to 102 but with magnesium alloy compressor casing. Coil ignition. Powers the S.E. Mistral.

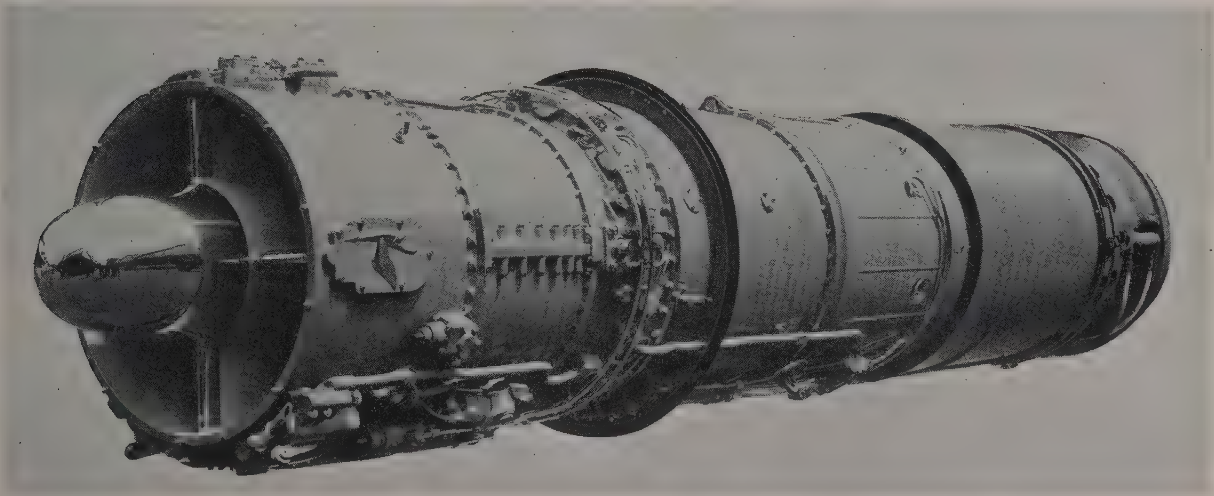
Nene 104 BR. Nene 104 fitted with Hispano-Suiza R401G afterburner.

Nene 105. Current production version. Description below refers to this model. Powers the Dassault M.D. 450 Ouragan.

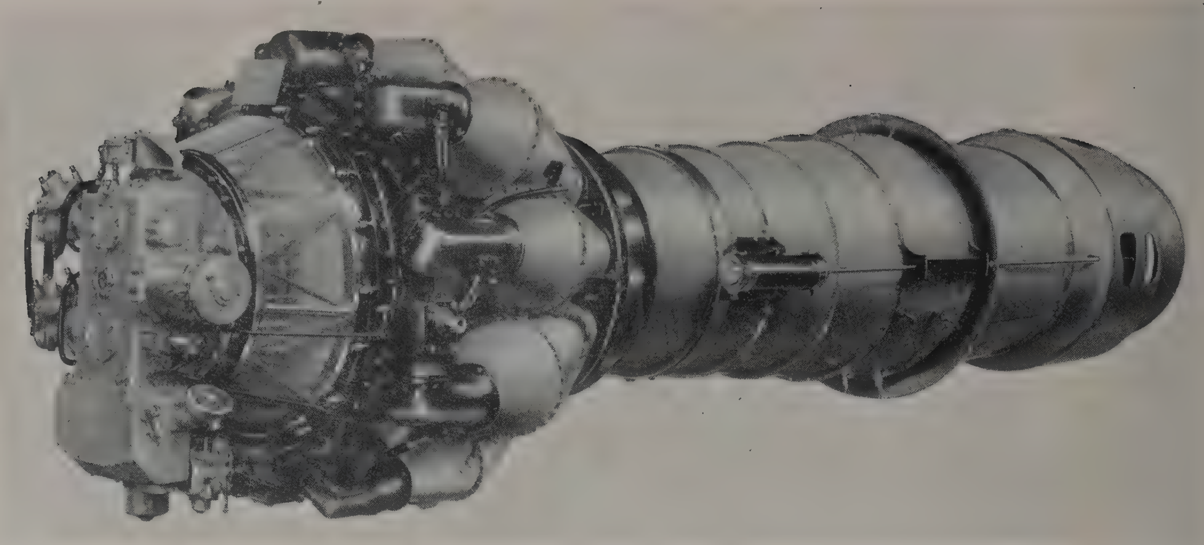
Nene 105 AR. Nene 105 fitted with Hispano-Suiza R401G afterburner.

Type.—Centrifugal-flow turbojet.

Compressor.—Single-stage double-entry compressor with double-sided impeller. Impeller has 29 vanes per side, with separate forged aluminium-alloy rotating guide



The Hispano-Suiza R.800 lightweight turbojet engine, here seen with afterburner fitted.



The Hispano-Suiza Nene 105 AR turbojet engine with Hispano-Suiza R401G afterburner.

vanes machined all over. Compression ratio 4.4 : 1. Impeller shaft runs in two bearings, roller at front and deep-grooved ball at rear end, and is splined to turbine rotor shaft. Centrifugal fan on impeller shaft ahead of rear bearing directs cooling air on turbine disc and rear bearings. Two-piece magnesium-alloy casing Aluminium alloy diffuser having nine outlets and internally-vaned elbows connecting with combustion chambers. Mass air flow 41 kg. (90.2 lb.) per sec. at take-off r.p.m. (static).

Combustion Chambers.—Nine inter-connected straight-flow chambers each consisting of a sheet steel outer casing and an internal concentrically-mounted perforated flame tube with Air Equipement duplex burner in front end for downstream injection.

Fuel System.—Dual manifold system. Two Air Equipement (Lucas) variable-stroke multi-plunger pumps in parallel, each with built-in overspeed governor and relief valve. Air Equipement throttle control valve, high-pressure shut-off cock and pressurising valve. Barometric pressure control acts on servo mechanism in high-pressure pump to vary delivery according to altitude requirements. Acceleration control unit retards flow to prevent over-fueling. Maximum fuel pressure 130 kg./cm.^{2} (1,850 lb./sq. in.).

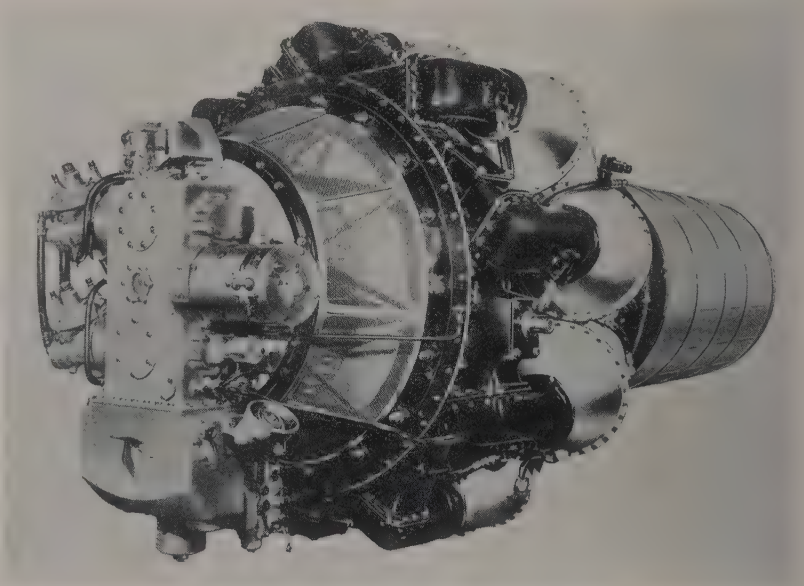
Fuel Grade.—Kerosene (Normal Air 3405).

Nozzle Guide Vanes.—48 cast steel guide vanes inserted in steel casing and diaphragm.

Turbine.—Single-stage axial flow. Solid steel disc with 54 solid blades with "fir-tree" roots inserted in periphery. Turbine shaft supported by compressor impeller shaft coupling and rear bearing and ball bearing ahead of turbine disc. Gas temperatures at take-off r.p.m. (static) 850°C. (1,562°F.) before, 700°C. (1,290°F.) after turbine.

Jet Pipe.—Sheet-steel outer casing and inner cone.

Afterburner (on Nene 104BR and 105AR).—Hispano-Suiza R.401G afterburner with clam-shell type variable-area exhaust exit.



The Hispano Suiza Nene 105 turbojet engine.

Hispano Suiza Duplex fuel, control and ignition systems.

Accessory Drives.—Wheelcase on front of engine, with drive from front end of impeller shaft, houses drives for tachometer generator, twin fuel pumps, etc.

Lubrication System.—Continuous circulation system with pressure feed to main bearings. Sump, containing gear type pump comprising one pressure and one scavenge unit, formed by lower part of wheelcase.

Starting.—Air Equipement (Rotax) electric starter.

Dimensions (Nene 105).—
- Max. diameter 1,258 mm. (49.5 in.).
- Length to exhaust cone flange 2,440 mm (96 in.).
- Frontal area 1.24 m.^{2} (13.3 sq. ft.).

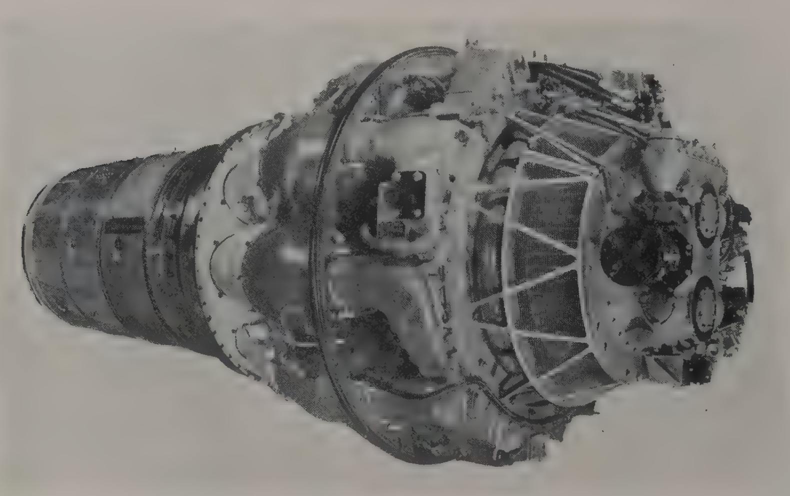
Weight (Nene 105).
- 730 kg. (1,606 lb.).

Weight (Nene 104 BR and 105 AR).—
- With afterburner and equipment 1,025 kg. (2,650 lb.).

Power Ratings (Nene 105).—
- Max. take-off 2,315 kg. (5,100 lb.) s.t. at 12,500 r.p.m. at sea level.
- Max. continuous 2,080 kg. (4,620 lb.) s.t. at 12,200 r.p.m. at sea level.
- Max. cruise 1,850 kg. (4,050 lb.) s.t. at 11,800 r.p.m.

Power Rating (Nene 104 BR and 105 AR).—
- Static thrust with afterburner (corrected) 3,080 kg. (6,800 lb.) at 12,500 r.p.m. at sea level.

Consumptions (Nene 105).—
- Fuel (cruising) 1 kg./kg. s.t./hr. (1 lb./lb. s.t. hr.).
- Oil (cruising) 0.20 kg./hr. (0.44 lb./hr.).



The Hispano-Suiza Tay 250 turbojet engine.

Fuel Consumption (Nene 104 BR and 105 AR).—
Max. at sea level 2.05 kg./kg. s.t./hr. (2.05 lb./lb. s.t./hr.).
Performance.—
Max. take-off 2,360 kg. (5,200 lb.) s.t. at 12,300 r.p.m.
Max. continuous output 2,088 kg. (4,590 lb.) s.t. at 12,000 r.p.m.

THE HISPANO-SUIZA TAY 250A.

The Tay, of basic Rolls-Royce design. is a development of the Nene in which internal changes have been made to allow the engine to consume about 30 per cent. more air and in consequence to produce more thrust. In all other respects it is generally similar to the Nene and is essentially interchangeable with that engine.

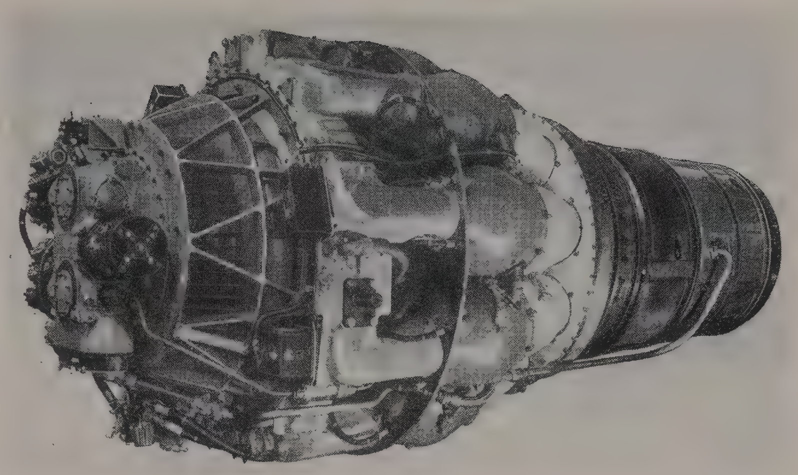
The Tay 250 is the first production engine and powers the Dassault Mystère II and Mystère IVA.

Dimensions.—
Max. diameter 1 270 m. (50 in.).
Overall length (without afterburner) 2.529 m. (99.6 in.).
Frontal area 1.27 m.² (13.6 sq. ft.).
Weight Dry.—
905 kg. (1,973 lb.).
Power Ratings.—
Max. take-off 2,850 kg. (6,280 lb.) s.t. at 11,000 r.p.m. at sea level.
Max. continuous 2,560 kg. (5,645 lb.) s.t. at 10,700 r.p.m. at sea level.
Static thrust with afterburner (corrected) 3,850 kg. (8,360 lb.).
Consumptions.—
Fuel (normal) 1.06 kg./kg. s.t./hr. (1.06 lb./lb. s.t./hr.).
Oil (normal) 0.25 kg./hr. (0.5 lb./hr.).

THE HISPANO-SUIZA VERDON 350.

The Verdon 350 is a development of the Tay 250, the principal modifications being generally similar to those employed to evolve the Tay from the Nene. These include internal changes to permit a greater flow of air through the engine ; an increase in turbine speed ; and a slight increase in the permissible gas temperature after the turbine. In other respects, the Verdon uses the greatest possible number of Tay components and is installationally interchangeable with the Tay.

The Verdon was first flown in a Dassault Mystère on August 3, 1953.



The Hispano-Suiza Verdon 350 turbojet engine.

Dimensions.—
Max. diameter 1.27 m. (50 in.).
Length 2.62 m. (103.2 in.).
Frontal area 1.26 m.² (13.6 sq. ft.).
Weight.—
Dry 935 kg. (2,057 lb.).
Performance Ratings.—
Take-off 3,500 kg. (7,700 lb.) s.t. at 11,100 r.p.m. at sea level.
Max. continuous 2,800 kg. (6,160 lb.) s.t. at 10,500 r.p.m. at sea level.
Climbing 3,150 kg. (6,930 lb.) at 10,850 r.p.m.
Consumptions.—
Fuel (max.) 1.1 kg./kg. s.t./hr. (1.1 lb./lb. s.t./hr.).
Oil 0.25 kg./hr. (055 lb./hr.).

RATEAU

SOCIÉTÉ RATEAU.

Head Office and Works : Rue Rateau, La Courneuve (Seine).

Director-General : M. René Anxionnaz.

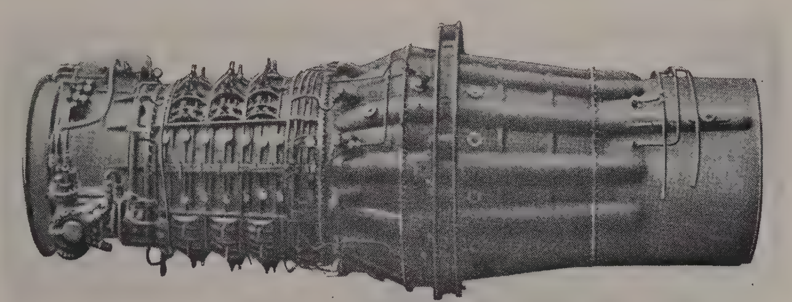
Deputy Director-General : Louis Hermitte.

Technical Director : Professeur Marcel Sedille.

The Société Rateau, well-known for its work with turbo-superchargers, began the development of turbo reaction motors in 1939. It has now under development the SRA-101, suitable for high-speed military aircraft, particulars of which are given below.

THE RATEAU SRA-101 SAVOIE.

Type.—Axial-flow turbojet with ten stage compressor and two stage turbine.
Compressor.—Axial-flow ten-stage compressor rotor on common shaft with turbine the whole enclosed in single steel casing. Ten rotor discs each with one row of steel blades. One row of inlet guide vanes and ten rows of steel fixed blades on casing. Tubular shaft carrying rotating assembly runs on three ball bearings, two forward of compressor and one aft of turbine. Compression ratio 6.8. Mass air flow 53 kg. (117 lb.) per sec. at take-off r.p.m.
Combustion Chambers.—Twelve straight-through tubular stainless-steel combustion chambers each enclosing a perforated flame tube with fuel atomiser at front end.
Fuel System.—Single manifold Rateau injection pump with automatic regulator. Maximum fuel supply pressure 15 kg./cm.² (215 lb./sq. in.).
Fuel.—Gasoline or Kerosene.
Turbine.—Two-stage turbine. Alloy steel turbine wheels and blades. On common tubular shaft with compressor.
Jet Pipe.—Adjustable inner cone enclosed in outer casing, both of stainless steel.
Lubrication.—Dry sump. Four-unit gear pump. Main bearings pressure fed. Normal oil supply pressure 4 kg./cm.² (57 lb./sq. in.).
Starting.—Rotax direct-drive electric starter. Four igniter plugs and high tension coils.



The Rateau SRA-101 Savoie turbojet engine.

Dimensions.—
Diameter 1.120 m. (44 in.).
Length (less tail-pipe) 3.350 m. (137.5 in.)
Weight.—
1,040 kg. (2,288 lb.).
Performance Rating.—
Take-off (static) with water injection 4,000 kg. (8,800 lb.) at 9,500 r.p.m. at sea level.
Take-off (static) without water injection 3,300 kg. (7,300 lb.) at 9,500 r.p.m. at sea level.
Climbing thrust 2,900 kg. (6,400 lb.) at 9,250 r.p.m. at sea level.
Normal cruising thrust 2,300 kg. (5,070 lb.) at 8,800 r.p.m. at sea level.
Consumptions.—
Fuel (normal without water injection) 0.85 kg./kg. thrust/hr. (0.85 lb./lb. thrust/hr.).
Oil 3.2 kg./hr. (7.04 lb./hr.).

S.N.C.A.N.

SOCIÉTÉ NATIONAL DE CONSTRUCTIONS AÉRONAUTIQUES DU NORD (S.N.C.A.N.).

Head Office : 12 *bis* Avenue Bosquet, Paris (7e).

Development Centre : Chatillon-sons-Bagneux (Seine).

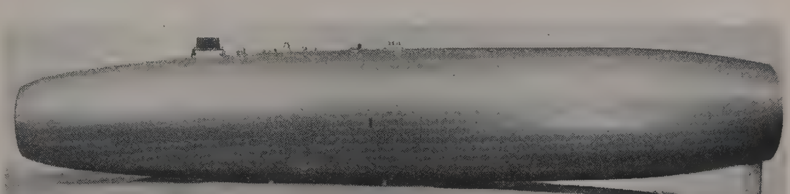
Towards the end of 1954 the former Société Française d'Etudes et de Constructions de Matériels Aéronautiques Spéciaux (S.F.E.C.M.A.S.) was merged with the Société National de Constructions Aéronautiques du Nord (S.N.C.A.N.).

The S.N.C.A.N. is continuing the development of various types of ramjets, pulse-jets and rocket motors to be used as primary power-units or as auxiliary motors for aircraft and missiles, subsonic as well as supersonic.

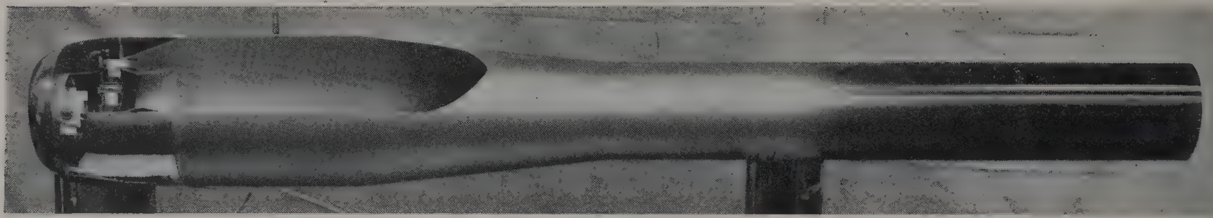
Among these types the ARS 600 and 900 high subsonic ramjets may be quoted with the characteristics given below.

THE S.N.C.A.N. ARS 600 RAMJET.

Dimensions.—
Length 3,250 mm. (127.9 in.).
Diameter 600 mm. (23.6 in.).
Weights*.—
72 kg. (158.4 lb.).



The S.N.C.A.N. (S.F.E.C.M.A.S.) ARS 600 Ramjet.



An S.N.C.A.N. Pulsejet which has a static thrust rating of 182 kg. (400 lb.) at sea level.

Performance.—
†Net thrust at S/L. at 1,000 km.h. (621 m.p.h.) 500 kg. (1,100 lb.).
†Net thrust at 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 120 kg. (264 lb.).
Fuel Consumption.—
At sea level at 1,000 km.h. (621 m.p.h.) 0.80 kg./sec. (1.76 lb./sec.).
At 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 0.19 kg./sec. (0.42 lb./sec.).

THE S.N.C.A.N. ARS. 900 RAMJET.

Dimensions.—
Length 4,125 mm. (162.4 in.).
Diameter 900 mm. (35.4 in.).
Weight*.—
110 kg. (242 lb.).
Performance.—
†Net thrust at S/L. at 1,000 km.h. (621 m.p.h.) 1,140 kg. (2,510 lb.).
†Net thrust at 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 285 kg. (627 lb.).
Fuel Consumption.—
At sea level at 1,000 km.h. (621 m.p.h.) 1.8 kg./sec. (3.96 lb./sec.).
At 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 0.45 kg./sec. (0.99 lb./sec.).

*Weights given include diffuser, combustion chamber, flameholder, injection grid with fuel injectors, and ramjet nozzle.

†Net thrust is the force transmitted to the attachment points.

SNECMA

SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION (SNECMA).

Head Office: 150 Boulevard Haussmann, Paris (XIIIe).

Works: Paris (Boulevard Kellermann), Billancourt (Seine), Villaroche (Seine-et-Marne), Suresnes (Seine) and Gennevilliers (Seine).

President and Director-General: Henri Desbruères.

Administrative Director: M. Depallens.

Technical Director: H. Oestrich.

Director-Controller: Marcel Richer.

Director of External Relations: Gilbert Racine.

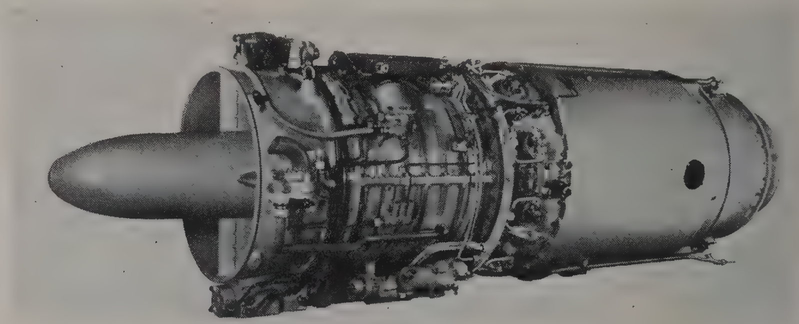
Personnel Manager: M. Dugue MacCarthy.

The Société Nationale d'Etude et de Construction de Moteurs d'Aviation (SNECMA) is actually devoting the major part of its activities to the development and series production of gas-turbine engines.

Several Atar 101-engined prototypes flew for the first time in 1952, 1953 and 1954, including the Sud-Ouest S.O. 4050 Vautour, the Dassault M.D. 452 Mystère II, the Sud-Est S.E. 5000 Baroudeur, and, since January, 1954, the S.F.E.C.M.A.S. 1402 delta wing monoplane. All the M.D. 452 Mystère II fighters now in production for the French Air Force will be Atar-powered.

The latest SNECMA turbojet engines are the Vulcan, the Atar 8 and the Vesta, brief details of which follow.

SNECMA continues its development in the field of pulsating jet units and brief details of the Escopette and Ecrevisse units are given hereafter.



The SNECMA Vesta lightweight turbojet engine.

THE SNECMA VULCAIN.

The Vulcain is an axial-flow turbojet engine of new design of which no details were available at the time of closing for press. The initial calculations for the design were begun on June 15, 1951, and the first prototype engine was ready to run on May 21, 1952.

The designed sea level static thrust of the Vulcain is 4,500 kg. (9,900 lb.) but in May, 1954, it completed a 15-hour rating test at 5,500 kg. (12,100 lb.) thrust. The weight of the engine with tailpipe is 1,525 kg. (3,355 lb.) and the overall diameter 1,160 mm. (45.6 in.).

First flight testing of the Vulcan has been made in a Sud-Est S.E. 2010 Armagnac, while several prototypes to be powered by the Vulcain are under development.

THE SNECMA VESTA.

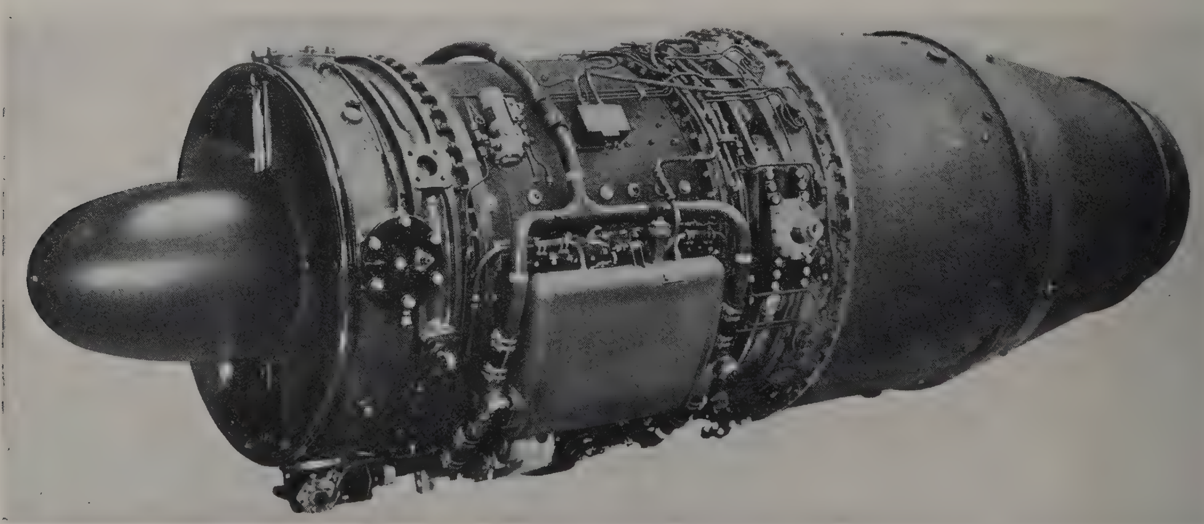
The Vesta is a small axial-flow turbojet engine which has been designed to meet a French Air Ministry requirement for a power-unit for installation primarily in lightweight fighter aircraft.

The Vesta has a nine-stage compressor, and annular combustion chamber and a single-stage turbine. The only other details available for publication are the following:—

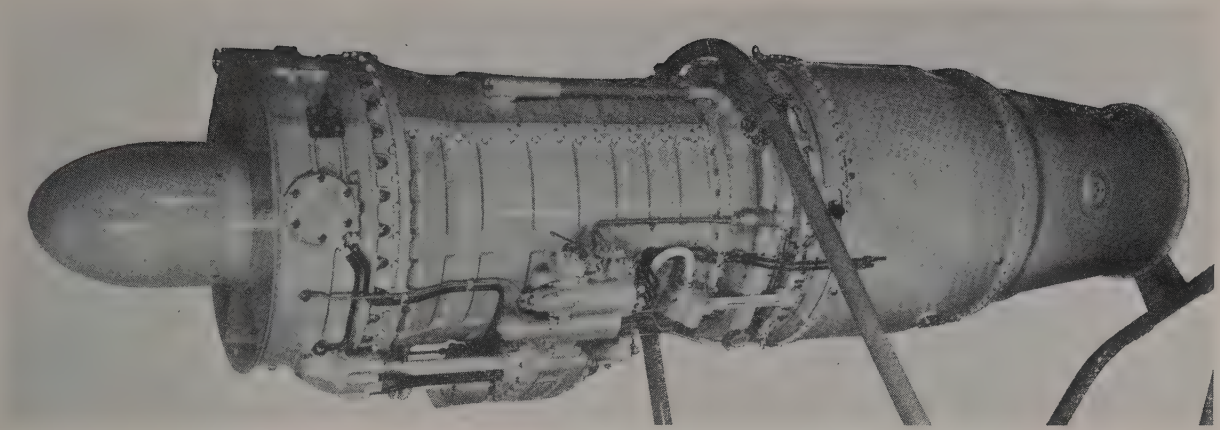
Dimensions.—*
Length 2.00 m. (78.7 in.).
Diameter 0.68 m. (26.8 in.).
Dry Weight.—
290 kg. (640 lb.).
Performance Rating.—
Max. (static) rating 1,200 kg. (2,645 lb.) s.t.

THE SNECMA ATAR 8.

The Atar 8 is a large dual-compressor turbojet engine of completely new design which was exhibited in public for the first time at the 1955 *Salon de l'Aéronautique*. Its external characteristics can be gathered from the illustration on the following page.



The SNECMA Vulcain axial-flow turbojet engine which has a thrust rating of 5,500 kg. (12,100 lb.).



The SNECMA Atar 8 two-spool turbojet engine (4,200 kg.=9,240 lb. s.t. at sea level).

Beyond the fact that the Atar 8 has a preliminary thrust rating of 4,200 kg. (9,240 lb.), no other details are available.

THE SNECMA ATAR 101 SERIES.

The following are the principal versions of the Atar 101 :—

Atar 101A. Advanced prototype. 2,200 kg. (4,850 lb.) s.t. Seven-stage compressor, annular combustion chamber with 20 burners, single-stage turbine. Small number built and none installed in aircraft.

Atar 101B. Pre-production series. 2,400 kg. (5,290 lb.) s.t. Flown in test-beds and fitted experimentally in Dassault M.D. 450 and prototypes of S.O. 4050.

Atar 101C. Production engine. 2,800 kg. (6,170 lb.) s.t. Modified combustion chamber and burners. Eyelid-type jet pipe. Electric starter incorporated in nose bullet. All engine accessories integrated in engine, including oil tank. Installed in prototype and pre-production versions of S.O. 4050 Vautour, S.E. 5000 Baroudeur, Dassault M.D. 452 Mystère II, S.F.E.C.M.A.S. 1402 Gerfaut.

Atar 101D. 3,000 kg. (6,610 lb.) s.t. Further modifications to combustion chamber and larger turbine. Fitted in pre-production versions of the S.O. 4050, S.E. 5000, ARS 1402, Leduc 0.22, and in production version of Dassault M.D. 452 Mystère II.

Atar 101E. 3,500 kg. (7,715 lb.) s.t. Modified eight-stage compressor, and other minor changes. Installed in production S.O. 4050 Vautour.

Atar 101F. Similar to 101D but fitted with afterburner. 3,800 kg. (8,360 lb.) s.t. with afterburning. Powers pre-production Dassault Mystère IV B-1, and a number of prototypes.

Atar 101G. Same as 101E but with afterburner. 4,200 kg. (9,240 lb.) s.t. with afterburning. Powers production Dassault Mystère IV B.

The description which follows refers specially to the Atar 101E.

Type.—Axial-flow gas turbine with annular combustion chamber and single-stage turbine.

Compression. — Eight - stage compressor. Rotor drum built up from individual discs, the rotor blades having prismatic roots which slide into corresponding slots in the periphery of the discs. Stub shafts flanged on each end of drum run in ball (forward) and roller (aft) bearings. Two-piece light alloy casing with inserted light metal guide vanes. Between compressor and combustion chamber is an entry casing which, apart from the ring of burners and fuel injectors, contains the rear compressor bearing and the drives for accessories and oil pumps. Compression ratio 4.5 at 8,500 r.p.m.

Combustion Chamber.—Sheet steel annular chamber with twenty single burners. Air from compressor is divided into primary and secondary air at the combustion ring, the primary air alone streaming through burners. The secondary air is ducted to enter the combustion chamber through the holes of the concentrically arranged inner annular liners. Fuel is injected downstream into primary air through ATAR 661 dual-flow injectors. Ten starting injectors and two igniter plugs.

Fuel System.—ATAR 534 fuel pump unit consisting of centrifugal pump, filter and high-pressure gear type pump. ATAR 6.200 single-lever control regulating automatically r.p.m. and temperature.

Fuel Specification.—Turbofuel Norme AIR 3405 (density 0.810) or JP-4.

Nozzle Guide Vanes.—Air-cooled sheet steel nozzle guide vanes precede the turbine.

Turbine.—Single-stage turbine with fifty-nine blades of chrome-nickel alloy. Turbine drives the compressor *via* a movable tooth coupling and a large hollow shaft.

Jet Pipe.—Jet nozzle, of which there are two types, controlled by governor. Clamshell type actuated by hydraulic servo-mechanism, or variable-area nozzle devoid of any moving part.

Accessory Drives.—Drive on compressor entry casing for permanent output of 35 h.p. for driving airframe accessories.

Lubrication.—Dry sump. One pressure pump and scavenge pumps. Centrifugal oil cleaner in oil return. Oil-fuel heat exchanger. Normal oil pressure 4 kg./cm.² (57 lb./sq. in.).

Starting.—Air Equipement 50.991 (Rotax licence) electric starter.

Dimensions (Atar 101E).—
Length 4.43 m. (175 in.).
Diameter 0.92 m. (36.2 in.).

Dimensions (Atar 101G with afterburner).—
Length 6.48 m. (255 in.).
Diameter 0.92 m. (36.2 in.).

Weight Dry (Atar 101E). -
960 kg. (2,112 lb.).

Weight Dry (Atar 101G).—
1,220 kg. (2,684 lb.).

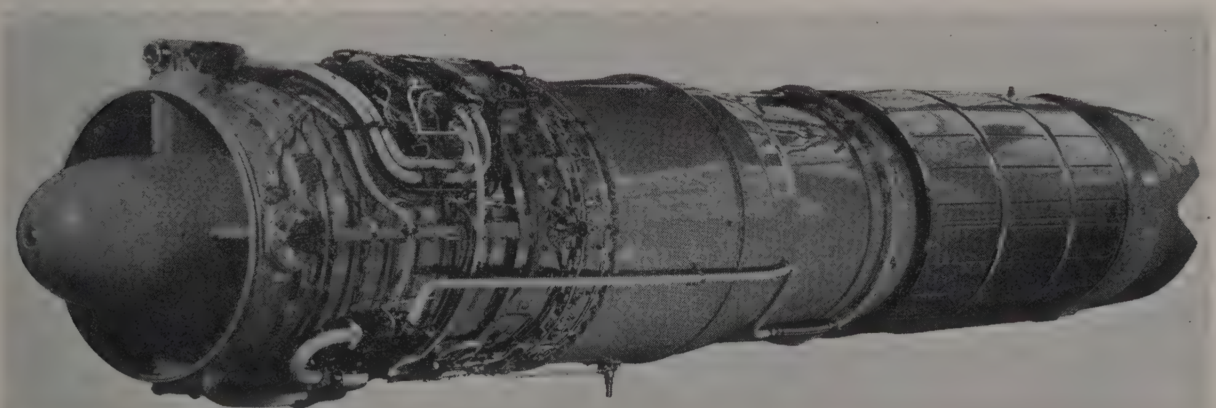
Performance Rating (Atar 101E).—
Max. s.t. at S/L. 3,500 kg. (7,700 lb.).
Max. continuous at S/L. 2,800 kg. (6,160 lb.).

Performance Ratings (Atar 101G).—
Max. s.t. at S/L. with afterburner 4,200 kg. (9,240 lb.).
Max. s.t. at S/L. 3,400 kg. (7,480 lb.).
Max. continuous at S/L. 2,700 kg. (5,940 lb.).

THE SNECMA THRUST REVERSER.

SNECMA has developed and successfully tested a device for the reversal, or partial reversal, of the jet stream of a gas-turbine engine to provide a means of braking comparable with that produced by a reversible-pitch airscrew on a piston or turboprop engine.

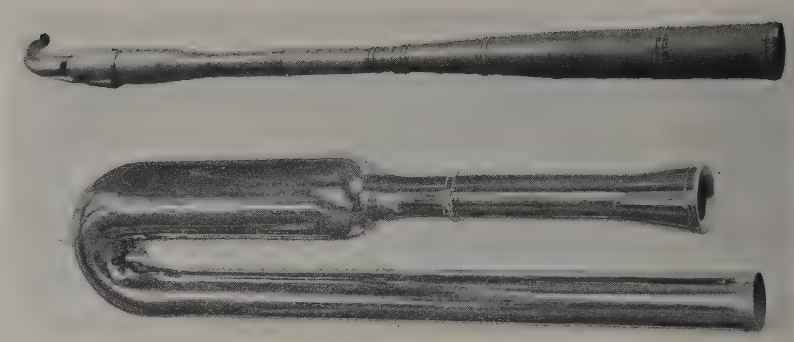
The device consists of a series of annular deflector vanes concentric with the thrust line and fitted at the exhaust end of the tail-pipe. The jet stream deflection, that is, the forcing of the main stream outward into the vanes and so turning the stream outward and forward to produce negative thrust, may be obtained either mechanically, by the interception of a small part of the centre of the flow by a retractable obstacle; or aerodynamically, by the introduction of secondary air tapped from the compressor into the centre of the flow ; or by both combined.



The SNECMA 101-F turbojet engine with SNECMA afterburner. This engine has a thrust rating of 3,800 kg. (8,360 lb.) with afterburning.

Following wind-tunnel tests, the device was fitted to a Goblin engine of a Vampire and first flight-tested in July, 1952. The landing run of the Vampire has been reduced by half with the thrust reverser and normal use of wheel-brakes. The thrust reverser has also been tested successfully on other types of engines, including the Turbomeca Piméné and the SNECMA Atar 101D.

Development work continues and is concerned mainly with the improvement of performance, and the application of the thrust reverser to engines fitted with afterburning.



Two SNECMA pulse-jet units, the Escopette above and the Ecrevisse below.

SNECMA PULSE-JETS.

SNECMA has been engaged since 1950 in the development of pulse-jet units which are devoid of all moving parts.

The first pulse-jet was the Escopette (Carbine) which weighs 4.8 kg. (10.5 lb.) and develops a static thrust of 10 kg. (22 lb.). The unit is provided at its front end with a "recuperator," the function of which is to reverse the undesirable forward flow of gases at the time of explosion. The remainder of the unit, comprising the aerodynamic flow valve, the combustion chamber with burner and starting plug, body and jet-pipe, is an unobstructed tube of varying diameters, the gas movements being regulated by the dissymetrical aerodynamic form of the flow valve. The overall length of the Escopette is 2,800 mm. (113.25 in.). A development of the Escopette, known as the Tromblon (Blunderbuss), has given a greater thrust and lower specific fuel consumption.

The Escopette and Tromblon pulse-jets, in combinations of four and six, have been flight-tested in Emouchet type sailplanes, over 400 flights having been made.

The latest development in SNECMA pulse-jets is the Ecrevisse (Crayfish). In this the "tube" itself is bent double through 180°, which makes it possible to dispense with the "recuperator" found on the Escopette. Air, induced to enter the flow valve through the aft facing inlet above, mixes with fuel fed through the single burner in the combustion space to form a self-igniting mixture, the hot gases passing out through the lower orifice. The internal depression caused by the inertia of the escaping gas draws in a fresh charge of air. The tube resonates at about 60 cycles per second.

The Ecrevisse Type A, which weighs 6 kg. (13.2 lb.) and has an overall length of 1,540 mm. (60 in.), develops a maximum thrust of 20 kg. (44 lb.), while the Type B which is 2,480 mm. (97.5 in.) long and weighs 10 kg. (22 lb.), attains a thrust of 30 kg. (66 lb.). The consumption of the Type B Ecrevisse is 1.35 kg./kg. s.t./hr. (1.35 lb./lb. s.t./hr.).

Research is proceeding in connection with various possible applications of pulse-jet units, some of which cannot be disclosed.

TURBOMECA

SOCIÉTÉ TURBOMECA.

Head Office and Works: Bordes (Basses-Pyrénées).

Paris Office: 56, Rue du Faubourg St.-Honoré.

President and Director General: J. R. Szydlowski.

The Société Turbomeca was formed in 1938 by MM. Szydlowski and Planiol to develop blowers, compressors and turbines for aeronautical use.

In June, 1940, the company was instructed to move from Billancourt to Bordes in the Pyrenees, where it continued to work until the complete occupation of France. Its factory was pillaged by the enemy but after re-equipment after the Armistice work was resumed on the manufacture of compressors for Hispano-Suiza and Gnôme-Rhône engines, and on the development of cabin supercharging and air-conditioning compressors, centrifugal and axial-flow compressors for research and industrial uses, and gas-turbines.

In 1947 the company began the development of gas-turbines of low power for driving aircraft auxiliaries and for aircraft propulsion.

The company's first small turbojet engine was the Piméné, which first flew in the Fouga Cyclone powered-sailplane on July 14, 1949. The Piméné was the first French turbojet engine to pass the official homologation tests at Chalais Meudon under I.C.A.O. conditions.

The range of Turbomeca gas-turbine engines now includes the Gabizo (1,100 kg.=2,420 lb. s.t.), Gourdon (660 kg.=1,450 lb. s.t.), Marbore II (400 kg.=880 lb. s.t.), Arbizon (250 kg.=550 lb. s.t.) and Palas (160 kg.=352 lb. s.t.) turbojet engines; the Soulor (320 kg.=700 lb.) ducted-fan engine; the Marcadau turboprop (400 h.p. s.h.p.); the Orédon (158 s.h.p.) and Artouste (400 s.h.p.) shaft turbines; and the Autan, Pimédon, Palouste and Arius turbo-compressors.

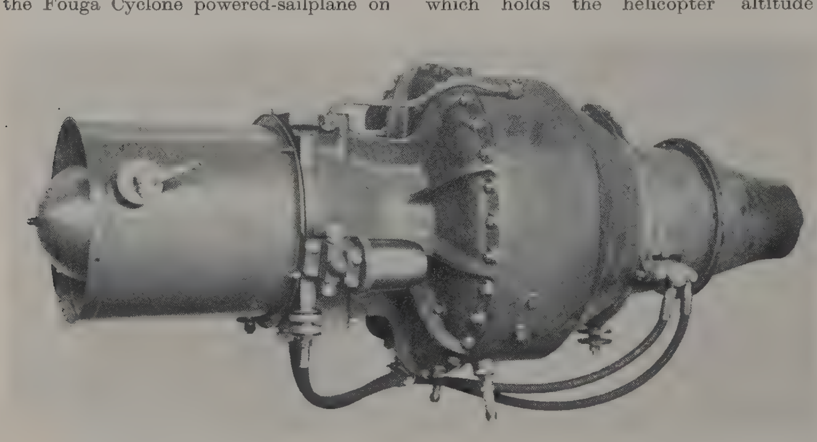
Both the Palas and Marboré turbojets are installed in a number of aircraft. The Marboré II powers, among other aircraft, the Fouga 170 Magister twin-engines trainer which is in production for the French Air Force and the French Navy, and the Morane-Saulnier 755 and 760.

The shaft turbine engines are suitable for many applications where useful horsepower is required at a single mechanical coupling. The Artouste II engine is for example driving the tractor airscrew of the Sud-Ouest S.O. 1310 Farfadet gyroplane, and also drives the rotor of the Sud-Est 3130 Alouette II helicopter, which holds the helicopter altitude record at 8,215 m. (26,936 ft.) and is in production for the French Navy. It also powers the American Sikorsky S-59 helicopter.

The compressed air generators are also suitable for many applications, including helicopter power-drives, starting power for large gas-turbines, etc. The Arius was used to supply compressed air to the rotor-tip combustion chambers in the S.O. 1120 Ariel III helicopter and S.O. 1310 Farfadet gyroplane, while the Palouste supplies propulsive air to the rotor-tip jets of the S.O. 1220 Djinn helicopter.

A remarkable degree of interchangeability exists among the whole range of Turbomeca engines.

Licences for Turbomeca gas-turbines have been negotiated with the Blackburn and General Aircraft, Ltd. in England, and the Continental Aviation & Engineering Corporation in the United States.



The Turbomeca Palas light turbojet engine.

THE TURBOMECA PALAS.

Type.—Turbojet with single-stage compressor, annular combustion chamber with rotating fuel delivery ring and single-stage turbine.

Compression.—Single-stage centrifugal compressor. Compression ratio 3.9 : 1.

Combustion Chamber.—Annular, with rotary fuel injection. The fuel ring, around the periphery of which are a number of vents, is attached to the shaft connecting compressor and turbine discs and revolves with it. Fuel is fed into the inside of the ring and is vented by centrifugal force, being vaporised in the process. Fuel delivery at low thrust settings regulated by by-pass valve.

Turbine.—Single-stage single-piece turbine with 31 blades preceded by stator with twenty air-cooled vanes. Turbine r.p.m. 35,000. Gas temperature before turbine 700°C., after turbine 600°C.

Fuel Pump.—Turbomeca. Maximum pressure 4 kg./cm.^{2} (57 lb./sq. in.).

Fuel.—Kerosene.

Starter.—Air Equipement 24 volt electric or compressed-air starter. One igniter plug.

Mounting.—Three mounting pads, two on compressor casing and one on underside of combustion chamber.

Dimensions.—
Length 891 mm. (35.1 in.).
Diameter 405 mm. (16 in.).

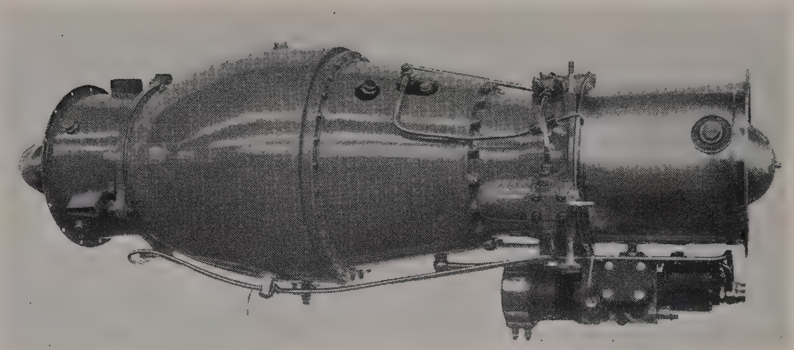
Weight Dry.—
72 kg. (159 lb.).

PERFORMANCE RATINGS.—
Max. T.O. (static) 160 kg. (353 lb.).
Normal thrust 130 kg. (287 lb.).
FUEL CONSUMPTIONS.—
At max. T.O. 1.17 kg./kg. s.t./hr. (1.17 lb./lb. s.t./hr.).
At normal thrust 1.13 kg./kg. s.t./hr. (1.13 lb./lb. s.t./hr.).

THE TURBOMECA ARBIZON.

The Arbizon, introduced in 1955, is a development of the Palas but no details, other than those given below, has been released for publication at the time of writing.

DIMENSIONS.—
Diameter 405 mm. (16 in.).
WEIGHT DRY.—
100 kg. (220 lb.).
PERFORMANCE RATINGS.—
Max. T.O. (static) 250 kg. (550 lb.).
Max. continuous 200 kg. (440 lb.).


The Turbomeca Arbizon turbojet engine.

THE TURBOMECA MARBORÉ II.

TYPE.—Turbojet with single-stage compressor, annular combustion chamber and single-stage turbine.

AIR INTAKE.—Annular sheet metal nose intake bolted to front of light alloy compressor casing.

COMPRESSOR.—Single-sided impeller machined from two alloy forgings, shrunk on steel shaft and locked and dowelled to maintain alignment. Externally-finned light alloy compressor casing supports front ball-bearing for rotating assembly in a central housing supported by three streamlined struts. This housing also contains gears for accessory drives. Compression ratio (at maximum r.p.m.) 3.95 : 1. Mass air flow 7.5 kg./sec. (16.55 lb./sec.).

COMBUSTION CHAMBER.—Composed of inner and outer sheet metal casings. forming annular flame tube. Air from compressor passes through both radial and axial diffuser vanes and divides into three main flows, two primary for combustion and one secondary. Two primary flows enter combustion zone from opposite ends of chamber, the rear stream through turbine nozzle guide vanes which it cools. Secondary flow enters through outer casing for dilution and cooling of combustion gases. Two torch igniters.

FUEL SYSTEM.—Fuel, pumped through hollow impeller shaft, is fed to combustion zone by rotating injector disc around periphery of which are number of vents which act as nozzles. Fuel is vented by centrifugal force, being atomised in the process. Fuel delivery at low thrust settings regulated by by-pass valve.

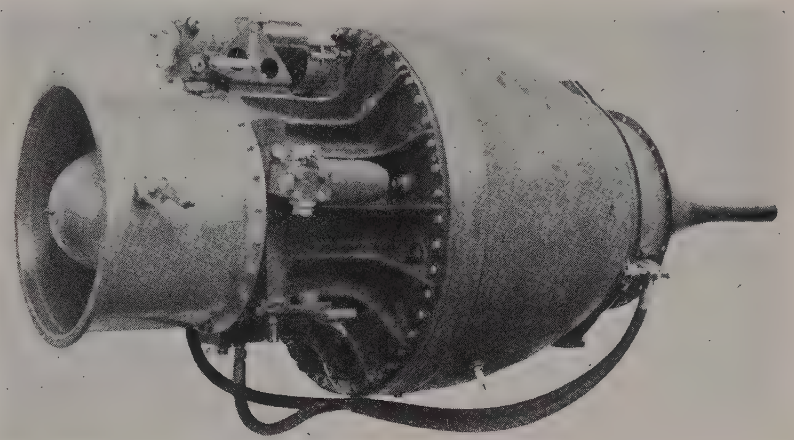
FUEL GRADE.—Aviation Turbofuel (D.Eng. R.D. 2482 or JP-4).

NOZZLE GUIDE VANES.—Twenty-five hollow sheet steel guide vanes cooled by part of primary combustion air.

TURBINE.—Single-stage turbine with thirty-seven blades integral with steel disc. Bolted to main shaft and tail shaft, latter supported by rear roller bearing for rotating assembly.

JET PIPE.—Inner and outer sheet metal casings, latter supported by three hollow struts. Inner tapered casing extends beyond end of outer casing to induce air-flow through struts to cool rear main bearing and inner casing.

ACCESSORY DRIVES.—Gear casing in central compressor housing with drives for fuel and oil pumps. Connecting shaft to underside of accessories gear case above compressor casing. Accessories include tachometer generator and electric starter. Take-off (4 h.p. continuous) for remotely-driven accessory box.


The Turbomeca Marboré II turbojet engine.

LUBRICATION SYSTEM.—Pressure type. Single gear-type pumps serves front gear casing, two main bearings and r.p.m. governor. Three scavenge pumps return bearing oil to tank *via* cooler. Normal oil pressure 2.8 kg./cm.² (40 lb./sq. in.).

OIL SPECIFICATION.—D.Eng. R.D. 2479.

MOUNTING.—Four points, with Silentbloc rubber mountings, two at front and two at rear.

STARTING.—Air Equipement 24-volt electric starter or compressed-air starter. Two igniter plugs.

DIMENSIONS.—
Length 1,100 mm. (44.3 in.).
Width 567 mm. (22.3 in.).
Height 288 mm. (11.4 in.).
WEIGHT.—
135 kg. (298 lb.).
PERFORMANCE RATINGS.—
Take-off (static) 400 kg. (880 lb.).
Max. continuous 360 kg. (795 lb.).
CONSUMPTIONS.—
Fuel (T.O.) 1.15 kg./kg. thrust/hr. (1.15 lb./lb. s.t./hr.).
Fuel (max. cont.) 1.10 kg./kg. thrust/hr. (1.10 lb./lb. s.t./hr.).

THE TURBOMECA GOURDON.

The Gourdon, introduced in 1955, is a centrifugal-flow turbojet engine of typical Turbomeca configuration. It has the following characteristics.

DIMENSIONS.—
Diameter 564 mm. (22.5 in.).
WEIGHT DRY.—
172 kg. (380 lb.).
PERFORMANCE RATING.—
Max. T.O. (static) 660 kg. (1,450 lb.).
Max. continuous 525 kg. (1,150 lb.).
FUEL CONSUMPTIONS.
At max. T.O. 1.02 kg./kg. s.t./hr. (1.02 lb./lb. s.t./hr.).
At max. continuous 0.96 kg./kg. s.t./hr. (0.96 lb./lb. s.t./hr.).

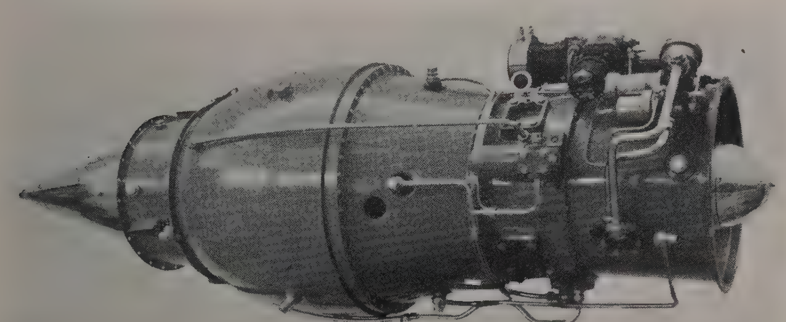
THE TURBOMECA GABIZO.

The Gabizo, a development of the Marboré II, was designed to meet the French Air Ministry requirements for an engine to power the light-weight fighter aircraft under development for the new French defence programme.

The Gabizo successfully completed the official 20-hour type-test in May, 1955. This test is made up of sixty twenty-minute cycles, each made up of a start, 15 minutes at T.O. rating, 5 minutes idling and stop.

The Gabizo will be given its first flying tests in a Sud-Ouest Espadon and it will also undergo altitude tests beneath the fuselage of a Canberra.

DIMENSIONS.—
Diameter 670 mm. (26.5 in.).
WEIGHT DRY.—
255 kg. (560 lb.).
PERFORMANCE RATINGS.—
Max. T.O. (static) 1,100 kg. (2,420 lb.).
Max. continuous 880 kg. (1,940 lb.).
FUEL CONSUMPTIONS.—
At max T.O. 1.04 kg./kg. s.t./hr. (1.04 lb./lb. s.t./hr.).
At max. continuous 0.96 kg./kg. s.t./hr. (0.96 lb./lb. s.t./hr.).


The Turbomeca Gabizo turbojet engine.

THE TURBOMECA SOULOR.

The Soulor, which is under development, is a ducted-fan engine. A prototype engine had not been completed at the time of writing.

DIMENSIONS.—
Diameter 460 mm. (18.5 in.).
WEIGHT DRY.—
140 kg. (310 lb.).
PERFORMANCE RATINGS.—
Max. T.O. 320 kg. (700 lb.).
Max. continuous 270 kg. (600 lb.).
FUEL CONSUMPTIONS.—
At max. T.O. 0.8 kg./kg. s.t./hr. (0.8 lb./lb. s.t./hr.).

THE TURBOMECA ARIUS I.

The Arius I, which supplies compressed air to the rotor-tip combustion chambers of the Sud-Ouest S.O. 1120 Ariel III helicopter, has the following characteristics.

DIMENSIONS.—
Length 1,358 mm. (53.5 in.).
Width 525 mm. (20.7 in.).
Height 557 mm. (21.9 in.).

WEIGHT (with accessories).—
132 kg. (291 lb.).

PERFORMANCE.—
Turbine shaft h.p. 280 at 36,000 r.p.m.
Air delivery (3.15 compression ratio) 1,260 gr./sec. (2.77 lb./sec.) at 34,000 r.p.m.
Air delivery (2.6 compression ratio) 1,210 gr./sec. (2.66 lb./sec.) at 32,000 r.p.m.

FUEL CONSUMPTION.—
120 kg. (264 lb.) per hour.

THE TURBOMECA ARIUS II.

This is a developed version of the Arius I. It has the following particulars :—

DIMENSIONS.—
Length 1,448 mm. (56.6 in.).
Width 435 mm. (20.7 in.).
Height 557 mm. (21.9 in.).

WEIGHT (with accessories).—
132 kg. (291 lb.).

PERFORMANCE.—
Air delivery (3.15 compression ratio) 1,800 gr./sec. (3.96 lb./sec.) at 34,000 r.p.m.
Air delivery (2.8 compression ratio) 1,580 gr./sec. (3.47 lb./sec.) at 32,000 r.p.m.

THE TURBOMECA ARTOUSTE II.

The Artouste is a shaft turbine. The two-stage turbine uses part of the available power to drive the compressor, the remaining power being free to drive a power take-off shaft.

TYPE.—Gas-turbine with centrifugal compressor, an annular combustion chamber and a two-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor. Compression ratio at 33,000 r.p.m. at S/L. 3.7 : 1. Air mass flow 3.1 kg./sec. (6.8 lb./sec.) at 33,000 r.p.m. at S/L.

COMBUSTION CHAMBER.—Annular type as in Palas.

FUEL.—AIR 3405 turbofuel. Normal aviation gasoline for starting.

OIL.—AIR 3512 (mineral) oil.

TURBINE.—Two-stage axial type. 1st stage 20 stator blades and 27 rotor blades. 2nd stage 34 stator blades and 25 rotor blades.

JET PIPE.—Fixed type. Diameter of diffuser exit 310 mm. (12.2 in.). Exhaust gas speed 100 m./sec. (328 ft./sec.) maximum. Exhaust gas temperature 550°C. maximum.

STARTING.—Air Equipment 24-volt starter. Two K.L.G. igniter plugs.

DIMENSIONS.—
Length 1,060 mm. (41.7 in.).
Height 545 mm. (21.5 in.).
Width 452 mm. (17.8 in.).

WEIGHT.—
110 kg. (242 lb.).

PERFORMANCE.—
Max. output (5 min.) 400 s.h.p. at 33.000 turbine r.p.m. plus 35 kg. (77 lb.) residual thrust at S/L.
Max. continuous output 320 s.h.p. at 33,000 turbine r.p.m. plus 30 kg. (66 lb.) residual thrust at S/L.

FUEL CONSUMPTIONS.—
At max. output 177 kg. (389 lb.) per hour.
At max. continuous output 160 kg. (352 lb.) per hour.

THE TURBOMECA ARTOUSTE III.

This is a developed version of the Artouste II which has the following characteristics.

WEIGHT DRY.—
150 kg. (330 lb.).

PERFORMANCE.
Max. output (5 min.) 600 s.h.p.
Max. continuous output 500 s.h.p.

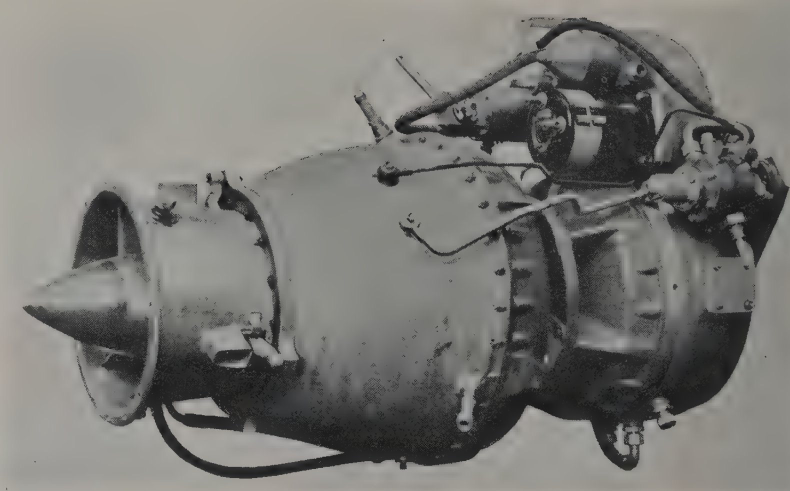
THE TURBOMECA MARCADAU.

The Marcadau is the Artouste II turbine with a propeller reduction gear of the spur type. The reduction gear ratio is 1 : 2.332. The centre-line of the propeller shaft is 130 mm. (5.1 in.) below the turbine shaft centre-line.

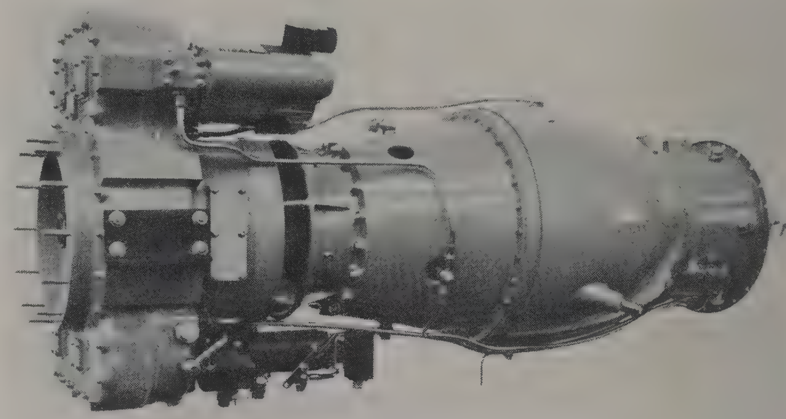
DIMENSIONS—
Length 1,390 mm. (54.8 in.).
Height 545 mm. (21.5 in.).
Width 452 mm. (17.8 in.).

WEIGHT (without propeller).—
139 kg. (307 lb.).

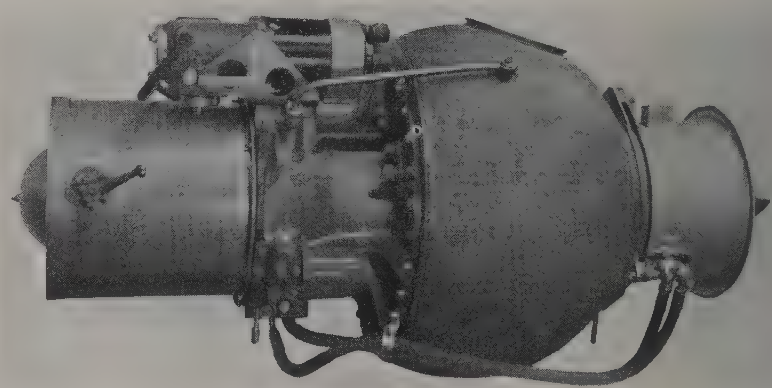
PERFORMANCE.—
T.O. output 400 h.p. at 2,500 shaft r.p.m. plus 35 kg. (77 lb.) residual thrust.



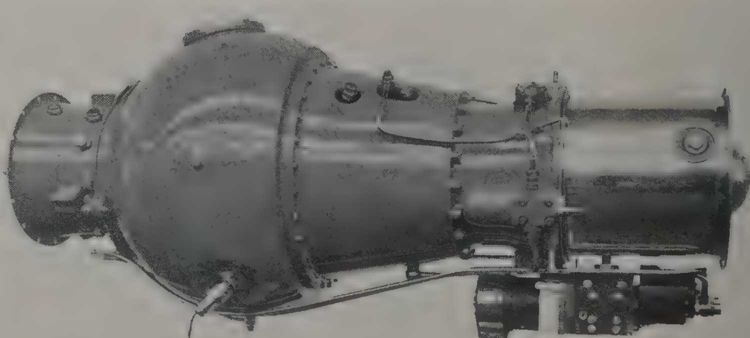
The Turbomeca Artouste II shaft turbine engine.



The Turbomeca Artouste III shaft turbine engine.



The Turbomeca Palouste turbo-compressor.



The Turbomeca Autan turbo-compressor.

Max. climb output 360 h.p. at 2,500 shaft r.p.m. plus 32 kg. (70 lb.) residual thrust.
Max. continuous output 320 h.p. at 2,500 shaft r.p.m. plus 30 kg. (66 lb.) residual thrust.

THE TURBOMECA PALOUSTE.

The Palouste is a turbo-generator which incorporates an oversize impeller in its compressor so that a proportion of the air may be taken from the engine after compression but before it enters the combustion chamber.

A Palouste turbo-generator is installed in the Sud-Ouest S.O. 1310 Farfadet gyroplane, where it supplies compressed air to the rotor-tip jets. This air is the rotor's sole means of propulsion.

The combustion chamber, turbine, accessory drives, etc. of the Palouste are similar to those of the Artouste.

Dimensions.—
Length 1,060 mm. (41.8 in.).
Height 500 mm. (19.7 in.).
Width 475 mm. (18.7 in.).
Weight (with accessories).—
90 kg. (198 lb.).

Performance (at ambient temperature of up to 45°C.).—
Air delivery (3.6 compression ratio) 860 gr./sec. (1.89 lb./sec.) at 35,000 r.p.m.
Air delivery (3.48 compression ratio) 760 gr./sec. (1.67 lb./sec.) at 34,000 r.p.m

THE TURBOMECA AUTAN.

The Autan, introduced in 1955, is a development of the Palouste. It has the following characteristics.

Weight (with accessories).—
100 kg. (220 lb.).
Performance.—
Air delivery (5.1 compression ratio) 1,350 gr./sec. (3 lb./sec.).
Fuel Consumption.
180 kg./hr. (400 lb./hr.).

THE TURBOMECA TURMO.

The Turmo is a shaft turbine which consists of a gas generator, comprising a compressor, combustion chamber and a single-stage turbine, the exhaust from which drives a "free" single-stage turbine. The "free" turbine drives the output shaft through a reduction gear. This kind of unit has the advantage of a very high starting torque.

Dimensions (Turmo I).
Length 1,146 mm. (45.2 in.).
Width 700 mm. (27.6 in.).
Height 550 mm. (21.7 in.).
Weight (Turmo I).—
240 kg. (530 lb.).
Performance (Turmo I).—
Max. shaft output 270 h.p. at 3,500 r.p.m.
Max. continuous shaft output 230 h.p. at 3,000 r.p.m.
Gas generator speed (max. continuous) 33,750 r.p.m.
Performance (Turmo II—without gear-box).—
Max. shaft output 400 h.p. at 28,000 r.p.m.
Max. continuous shaft output 360 h.p. at 24,000 r.p.m.
Gas generator speed (max. continuous 33,000 r.p.m.
Fuel Consumptions.
At max. continuous output (Turmo I) 112 kg. (247 lb.) per hour.
At max. continuous output (Turmo II) 180 kg. (397 lb.) per hour.

ITALY

FIAT

FIAT, SOCIETA PER AZIONI.

Office and Works: Via Nizza 250, Turin.

Director: Ing. Giovanni Perosino.

Head Office: Corso Giovanni Agnelli 200, Turin.

President: Prof. Vittorio Valletta.

General Manager: Eng. Gaudenzio Bono.

Divisional Manager: Eng. Guiseppi Gabrielli.

Stabilimento Avio (Aircraft Works).

Office: Via Nizza 250, Turin.

Manager: Eng. Giovanni Perosino.

Stabilimento Motore Avio (Aero-engine Works).

Office: Via Nizza 312, Turin.

The Fiat Company was incorporated in 1899 and started on a bold policy which catered for all forms of locomotion. It began with motor vehicles and gradually extended its production to include tractors, heavy-oil engines, railway trucks, tanks, aircraft and aircraft engines, etc.

The vast, new and modern Mirafiori works in Turin were inaugurated in the Spring of 1939.

The first aero-engines were built in 1908; during the first World War the Fiat company contributed to the Allied victory with 15,000 aero-engines.

After the war 1914-18 the company pursued a very intensive research programme, especially on vee-type water-cooled engines. This was the period during which the Italian aircraft, fitted with these engines, accomplished inter-continental and trans-Atlantic record flights, won such international competitions as the Bleriot and Schneider Trophies, and broke the international Speed, Distance and Altitude records.

After the last war Fiat entered the gas-turbine field by undertaking the licence-production of the de Havilland Ghost centrifugal-flow turbojet engine. It is also responsible for the maintenance and repair of the de Havilland Goblin engine, which is in service in the Italian Air Force.

Fiat has built a new factory for the manufacture of turbojet engines as well as a test establishment of the most up-to-date design.

In 1953 Fiat began manufacturing parts and assemblies of the Allison J35 turbojet engine for the U.S.A.F.

Fiat further undertakes, for the Italian Air Force and the Italian Civil airlines, the overhaul and repair of several types of piston engines, including the Fiat RA. 1050 (D.B.605); Pratt & Whitney R-985 and R-2800; Rolls-Royce Merlin 500 and Packard V-1650-7.

THE FIAT GHOST 48 Mk. 1.

This is a Ghost 3 turbojet engine which is built under a de Havilland licence. Constructional details of the Ghost engine will be found under "de Havilland." The following details are those of the Ghost 48 Mk. 1 as built by Fiat.

Dimensions.—
Diameter 134.6 cm. (53 in.).
Length 331.4 cm. (130.5 in.).
Frontal area 1.42 m.^{2} (15.3 sq. ft.).
Weight.—
962 kg. (2,120 lb.).
Performance Ratings.—
Take-off (static) 2,200 kg. (4,850 lb.) at 10,250 r.p.m. at sea level.
Normal (static) 1,883 kg. (4,150 lb.) at 9,750 r.p.m. at sea level.
Cruising (static) 1,460 kg. (3,220 lb.) at 9,000 r.p.m. at sea level.
Consumptions.—
Fuel (cruising) 1.07 kg./kg. thrust/hr. (1.07 lb./lb. thrust/hr.).
Oil (max.) 1.7 litres per hr. (3 pints per hr.).

JAPAN

FUJI

FUJI JUKOGYO KABUSHIKI KAISHA (Fuji Heavy Industries Co. Ltd.).

Head Office: Naigai Building 18, 2-chome, Marunouchi, Chiyoda-ku, Tokyo.

Aero Engine Factories: Mitaka, Tokyo and Omiya, Saitama Prefecture.

President and Director: Kenji Kita.

Executive Director: Takao Yoshida.

Managing Directors: Tsunchiko Mitsumoto, Tomizo Fujiu, Takeo Kotani and Toshio Matsubayashi.

Fuji Jukogyo Kabushiki Kaisha (Fuji Heavy Industries, Co., Ltd.) was formed on July 15, 1953, to undertake primarily the production of aircraft, aero-engines and accessories. One of the five share-holding companies which took part in its organisation and has since been absorbed therein, the Omiya Fuji Kogyo Kabushiki Kaisha, undertook in 1952 the development of a small axial-flow turbojet engine, for which a Government subsidy of 3,500,000 Yen was granted.

Work on this engine, the JO-1, has continued in the Omiya factory, now a unit of Fuji Heavy Industries, and the prototype, completed in the Summer of 1954, is, a year later, undergoing ground testing.

THE FUJI MODEL JO-1.

Type.—Axial-flow Turbojet.
Air Inlet.—Annular nose air inlet surrounding nose bullet.
Compressor.—Eight-stage axial-flow. First and eighth blade discs of stainless steel, the remainder are aluminium-alloy forgings. Compression ratio about 4 : 1.
Combustion Chambers.—Eight straight-through chambers of stainless steel each with a concentrically-mounted perforated stainless steel flame tube with duplex-type fuel injection nozzle in the front end and discharging downstream. Chambers are inter-connected to permit flame-spread during starting.
Fuel System.—Single fuel-manifold system. Fuel pressure at maximum power 50 kg./cm.^{2} (710 lb./sq. in.).
Nozzle Guide Vanes.—Forged steel ring with forty inserted and welded Nimonic 80A nozzle guide vanes.
Turbine.—Single-stage axial flow, with sixty solid blades inserted in periphery of alloy-steel disc. Gas temperatures (at 12,000 r.p.m.) before turbine 800°C., after turbine 630°C.
Jet Pipe.—Outer casing of stainless steel. Fixed inner cone.
Lubrication.—Wet sump. Main gear-type pump supplies oil to five main bearings. Auxiliary pump scavenges sump under turbine roller bearings and returns it to main pumps.
Starting.—Direct-drive electric. Two torch igniters.
Dimensions.—
Length 2,850 mm. (112 in.).
Diameter 680 mm. (26.7 in.).
Frontal area 0.33 m.^{2} (3.56 sq. ft.).
Weight Dry.—
450 kg. (990 lb.).
Performance Ratings.—
Max. static thrust 1,000 kg. (2,200 lb.) at 12,000 r.p.m.
Max. thrust at 800 km.h. (500 m.p.h.) at 9,000 m. (29,520 ft.) 400 kg. (880 lb.).
Fuel Consumption.—
1.11 kg./kg. s.t./hr. (1.11 lb./lb. s.t./hr.).

SOVIET UNION

(Union of Socialist Soviet Republics)

Little reliable information is available about the development of turbine power units in the U.S.S.R. The work is shrouded in great secrecy and is carried on by a number of Russian groups who have gradually improved on their own and German original designs. German workers are no doubt still making important contributions, but some of the earlier purely German designs are being "phased-out" of production.

Russian workers in this field who have been mentioned include Chelomei and Charomskii, as well as the rocket expert Kostikov, all of whom were responsible for development of jet power-units after the war. Many Russian scientists are known to have worked on rocket propulsion for a number of years.

In the period 1945-1947 there was extensive testing of small rocket units and athodyds on flying test-beds, but little has become known about this development in more recent years. The work on such units has been carried on, and there have been later reports of an original Russian design of pulse-jet which, it is alleged, has been used as an auxiliary power-unit in certain Russian fighters.

After the war, some of the well-known Russian piston-engine designers turned to jet engine design, among them Klimov and Mikulin. Shvetsov died in 1953, and probably had little time to make important original contributions, but he is said to have been responsible for an axial-flow unit with a 12-stage compressor.

Work on gas turbine engines in the U.S.S.R. has proceeded along two main lines—the improvement of German axial-flow units and the development and production of British centrifugal-flow gas turbines.

Large amounts of materials and data, and many workers, were obtained from Germany. This enabled the Russians to produce series of BMW 003A and Jumo 004B units, of relatively low power, which were used in the early Russian jet fighters such as the MIG-9, YaK-15 and YaK-17, and in other fighter and bomber prototypes.

Apart from the BMW and Junkers material, the Walther and Argus factories were also occupied by the Russians. Many important German technicians and engineers have been engaged in design and production work for the Soviet Air Fleet, and most of them are said to be located at the experimental test centre at Kuibyshev. The names of many have become known, but the exact projects on which they work are uncertain.

Reports say that further work on German engines has led to the production of Russian versions of the BMW 003E and Jumo 004H, and later, of the Jumo 012 and BMW 018, and their turboprop developments the PTL-022 and PTL-028. Apparently the prefix M- has been affixed to the designations of German engines when built in the U.S.S.R.; for example M-003, M-028, etc.

The Soviet Union received thirty Rolls-Royce Derwent 5 and twenty-five Nene 1 engines from the United Kingdom in 1947-1948. These engines were exported to Russia at the insistence of the then President of the Board of Trade, who overruled the objections of the Air Ministry and Rolls-Royce on the grounds that the engines were free from all security restrictions, and that there was no embargo on the export of such material to Russia.

The Nene engine found considerable favour with the Russians and it was quickly decided to instal it in the MIG-15. The Nene was immediately prepared for production under the designation M-45 (later RD-45) and it has passed through a number of different stages of development.

Captured examples of the RD-45 have been examined in both the U.S.A. and the United Kingdom, but no illustrations or detailed information have been made available for publication. The workmanship of the captured engines is said to be of a very high standard.

THE RD-45 (ex-M-45).

This Russian production version of the Nene has been built and improved upon in two if not three main stages. The latest version shows a line of improvement similar to that along which the Tay has been developed from the Nene by both Rolls-Royce and Pratt & Whitney. Without increasing the overall diameter the engine has been re-designed internally to permit about 30 per cent. more air to pass through the engine, and to enable it to develop a static thrust of 6,000 lb. (2,625 kg.) for an engine weight of 2,000 lb. (900 kg.) as compared with 5,000 lb. (2,270 kg.) s.t. and 1,715 lb. (780 kg.) weight of the original Nene. The latest RD-45 also employs water injection, but there is no confirmation that an afterburner has been added, although the enlarged tailpipe is said to be suitable for such an installation.

THE RD-45F.

This is a further improvement of the original M-45, but confirmed data are not available.

THE RD-500 (?).

RD-500 is the reported designation of the Derwent 5 built in the U.S.S.R. It retains the main features of its British prototype, and is installed in the YaK-23 jet fighter.

THE VK-1.

The VK-1 is an improved RD-45 which has been given a designation indicating that V.Ya. Klimov has been connected with its development. It provides the MIG-15*bis* with 2,700 kg. (5,955 lb.) of static thrust, using T-77 kerosene fuel.

THE MIKULIN 205.

Aleksandir A. Mikulin is one of the leading designers of Russian liquid-cooled piston engines, examples of which are still in use as the power-plant of the IL-10.

His "205" axial-flow gas turbine is said to have been in large-scale production since 1948. It has an 11 (or 12) stage compressor, and develops 4,500 kg. (9,920 lb.) of static thrust.

THE LU-4 (?).

The LU-4(?) axial-flow gas turbine is a recent Russian design which is credited to A. M. Lyul'ka. It is said to have a static thrust rating of 5,200 kg. (11,455 lb.). No other reliable data are available.

THE M-012.

The Russian-built version of the Junkers 109-012 gas turbine is said to have a 12-stage axial compressor. The original German model, which was only partly manufactured and never assembled, has a static thrust rating of 3,000 kg. (6,600 lb.), weighed 2,000 kg. (4,400 lb.); and was 4.5 m. (14 ft. 9 in.) long and had a diameter of 1.09 m. (3 ft. 7 in.). The original German design incorporated an 11-stage axial compressor, a 2-stage turbine, and 8 straight-through combination chambers.

THE M-018.

Plans and parts of the B.M.W. 109-018 were taken to the research centre at Kuibyshev. The original B.M.W. power-plant had a static thrust rating of 3,500 kg. (7,700 lb.) and weighed 2,500 kg. (5,500 lb.). It was 4 m. (13 ft. 2 in.) long and had a diameter of 1.27 m. (4 ft. 2 in.). There was a 12-stage axial compressor, an annular combustion chamber, and a three-stage turbine.

THE M-022.

The Junkers PTL-109-022 turboprop engine was designed in Germany during the war and the plans and technicians connected with the project were taken to the Soviet Union in October, 1946. It is said to have gone into series production in 1952 and is installed in the "Type 31" strategic bomber and various prototypes. Probable data for the Russian version are: 14-stage axial compressor and 3-stage turbine. Total power 5,000 e.h.p. (approximate; combined s.h.p. and jet thrust). Dry weight around 2,500 kg. (5,512 lb.), length approximate 5.18 m. (17 feet) diameter 1.1 m. (3 ft. 7 in.).

THE M-028.

This turboprop was only in the design stage at the B.M.W. plant in 1945. The Russian-produced model is said to give about 3,130 kg. (6,900 lb.) of static thrust, and it is also said to have been tested with an auxiliary B.M.W. 109-718 rocket unit, which gives an extra 3,000 kg. (6,618 lb.) for short periods.

The M-028 probably has a 12-stage axial compressor, an annular combustion chamber, and a 4-stage high-altitude turbine.

ROCKET UNITS.

Very little news is available of original post-war Russian work in the field of rocket power plants for piloted aircraft.

The Walther HWK 109-509 was described in the 1945-1946 edition of this Annual; it has been installed in the DFS 346 and various experimental Russian aeroplanes, and developments are used to power a target-defence interceptor.

The BMW 109-718 has also been studied in Russia.

SWEDEN

FLYGMOTOR

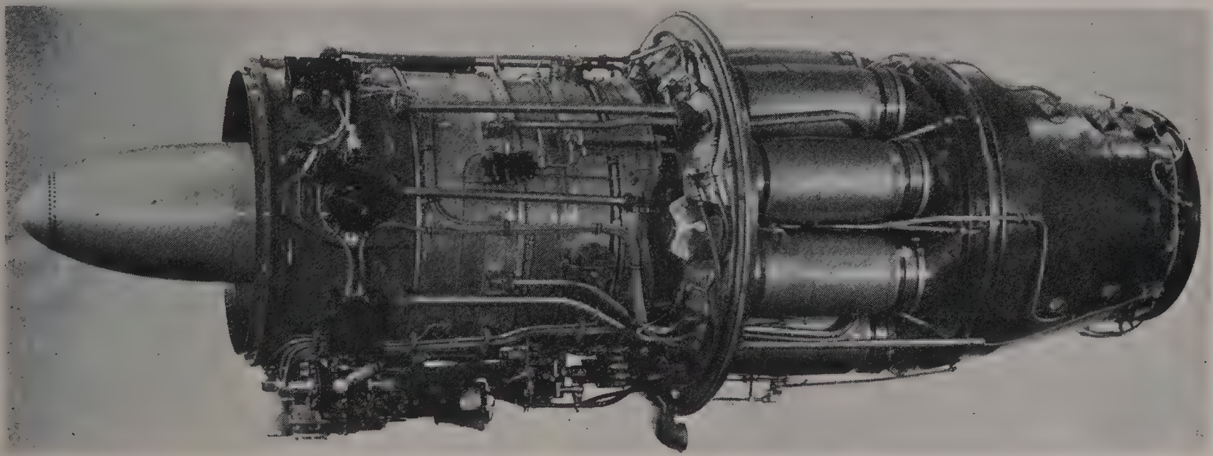
SVENSKA FLYGMOTOR AB.

Head Office and Works: Trollhättan.

Svenska Flygmotor AB. has acquired a licence to build the Rolls-Royce RA.7 axial-flow turbojet engine. The Avon powers the Saab-32 Lansen two-seat swept-wing all-weather fighter which has been ordered into production for the Royal Swedish Air Force.

Flygmotor also holds a licence from the de Havilland Engine Co., Ltd. to build the Goblin 3 and Ghost 45 engines which power the D.H. Vampire and Saab-29 fighters which are now in service in the Royal Swedish Air Force.

STAL



The STAL Dovern II axial-flow turbojet engine which has a static thrust rating of 3,300 kg. (7,260 lb.).

SVENSKA TURBINFABRIKS AB LJUNGSTRÖM (STAL).

Head Office and Works: Finspang.

The Svenska Turbinfabriks AB Ljungström, which originally formed part of the AB Ljungströms Angturbin (Ljungströms Steam Turbine, Ltd.) began the development of aircraft gas-turbines immediately after the war. A prototype engine named the Skuten (Witch) was exhibited at the Heat and Power Exhibition which was held in Stockholm in October, 1949.

The Skuten had eight axial-flow compressor stages, seven straight-through combustion chambers and a single-stage turbine. The static thrust was 1,450 kg. (3,200 lb.) and the weight of the engine was about 780 kg. (1,720 lb.). No other details of this engine have ever been released for publication.

A new and higher-powered axial-flow turbojet engine, known as the Dovern, has been designed and built and the prototype engine has been test flown in a converted Avro Lancaster.

THE STAL DOVERN II.

The Dovern II axial-flow turbojet engine exists in the following forms:—

Dovern IIA. Basic engine without de-icing. Net dry weight 1,195 kg. (2,629 lb.).

Dovern IIB. The IIA with de-icing equipment. Net dry weight 1,220 kg. (2,684 lb.).

Dovern IIC. The IIB with an afterburner which increases the static sea level thrust by 30 per cent.

The description below refers to the IIB.

Type.—Axial-flow turbojet.

Air Intake.—Annular magnesium-alloy nose intake with inner ring supporting front thrust bearing, power take-off and starter, with one row of inlet guide-vanes. Hollow struts, hollow inlet guide-vanes and nose bullet heated with hot air tapped from last compressor stage.

Compressor.—Nine-stage axial flow. Steel stator and rotor blades, the latter with dove-tail secured in peripheries of nine discs and locked against axial movement. Discs are welded together at outer rims and second and eighth discs are welded to stub shaft. Shaft carried on ball thrust bearing forward and roller bearing aft. Compression ratio 5.2 : 1. Mass air flow 55 kg./sec. (121 lb./sec.).

Combustion Chambers.—Nine interconnected tubular combustion chambers of straight-through flow type. Steel outer casings, Nimonic 75 concentrically-mounted flame tubes. Lucas duplex burners injecting downstream. Lodge igniter plugs in primary zone in two combustion chambers.

Fuel System.—Single manifold type. Two Lucas GC-200 multi-plunger variable-stroke pumps. Lucas SCH 2062 full range flow control with electrically-actuated high-pressure shut-off valve. Lucas SCH 2189 air-fuel ratio control. Lucas SCH 1735 flow distributor. Low-pressure filter. Max. fuel pressure 1,300 lb./sq. in.

Fuel Grade.—Aviation turbofuel (D.Eng. R.D. 2482).

Nozzle Guide Vanes.—70 solid vanes of N. 155 alloy.

Turbine.—Single stage axial-flow. Jessop H 46 alloy disc fixed to stub shaft by sixteen conical bolts. Ninety-seven blades of Nimonic 80A secured in periphery of disc by fir-tree roots. Gas temperature (at take-off) 870°C. before turbine, 675°C. after turbine.

Jet Pipe.—Fixed type of stainless steel. Afterburner in Dovern IIC.

Accessory Drives.—On left hand side there is a 70 h.p. power take-off for remote airframe-mounted accessory gear-box.

Lubrication System.—Dry sump system. Gear type pressure and scavenge pumps. 3-unit plunger type metering pump for main bearings. Tecalemit oil filter. Integral oil tank of 7 litres (1.5 Imp. gallons) capacity. Normal oil supply pressure 2.5—3.0 kg./cm.² (.35—.43 lb./sq. in.).

Oil Specification.—D.E.D. 2480.

Mounting.—Two mounting pads located near C.G. and free to move in a radial direction. A circular sliding ring on the compressor air intake is free to move in an axial direction.

Starter.—Rotax Exp. 4278 112-volt D.C. electric starter or B.T.H. 5-A1 two-shot cartridge starter mounted in nose bullet.

Dimensions.—
- Diameter 1,095 mm. (43 in.).
- Length 3,850 mm. (151.5 in.).
- Frontal area 0.94 m.² (10.1 sq. ft.).

Weight Dry.—
- 1,220 kg. (2,684 lb.).

Performance Ratings (Dry).—
- Take-off (static) 3,300 kg. (7,260 lb.) at 7,200 r.p.m. at S/L.
- Continuous (static) 2,600 kg. (5,720 lb.) at 6,800 r.p.m. at S/L.

Consumptions.—
- Fuel (normal) 0.92 kg./kg. s.t./hr. (0.92 lb./lb. s.t./hr.).
- Oil (normal) 0.6 kg./hr. (1.32 lb./hr.).

AEROJET

AEROJET-GENERAL CORPORATION

(Subsidiary of The General Tire & Rubber Company).

HEAD OFFICE AND WORKS: AZUSA, CALIFORNIA.

BRANCH PRODUCTION WORKS: SACRAMENTO, CAL., AND CINCINNATI, OHIO.

President: Dan. A. Kimball.

Executive Vice-President: A. H. Rude.

Vice-President and General Manager: W. E. Zisch.

Secretary: F. W. Knowlton.

Treasurer: T. S. Clark.

Assistant Secretary and Treasurer: T. E. Bechan.

Research Consultant: Fritz Zwicky.

The Aerojet-General Corporation is the largest manufacturer of rocket engines in the World and is outstanding in its field in the research and development of both liquid and solid propellant rocket engines and rocket propellants. The company originated the solid propellant JATO (jet assisted take-off) motor used by the Armed Forces of the United States during the last war.

Over 250,000 standard JATO units have been supplied to the U.S.A.F. and U.S. Navy during the past ten years.

Aerojet is presently devoting a considerable part of its effort to the development and manufacture of liquid and solid propellant jet assisted take-off rocket motors, liquid propellant guided missile power plants, and underwater rocket devices. It is the largest producer of solid propellant rockets in the United States.

Aerojet missile boosters and Jato rockets. From top to bottom: Models 2.2KS-33000, 5KS-4500, 2.2KS-11000, 15KS-1000, 14AS-1000 and (top right) 12AS-250 Junior Jato.

THE AEROJET MODEL 15KS-1000 Mk. 6, Mod. 1 ROCKET.

The 15KS-1000 (1,000 lb. of thrust for 15 seconds) "Smokeless" JATO rocket is now in full production, with first deliveries having been made to the U.S.A.F. and U.S. Navy.

Prior to the development of the 15KS-1000 unit, the use of JATO was accompanied by a large stream of smoke which trailed behind the aircraft when the unit is fired. In cases where the smoke did not dissipate, due to lack of wind, further operations were often affected owing to the smoke screen created by the first few take-offs. The new smokeless unit, which can operate over a much wider temperature range, gives an extra second of 1,000 lb. thrust with a 25% reduction in weight. The 15KS-1000 unit, which weighs 143 lb. (65 kg.), can be installed on the old type fittings without modification.

THE AEROJET MODEL 5KS-4500 Mk. 7, Mod. 1 ROCKET.

TYPE.—Single-chamber type JATO rocket motor.

PROPELLANT.—Solid type. Comprises solid fuel and oxydizer moulded into cartridge secured in cylindrical steel chamber.

IGNITION.—By electrically-energised glow-plug situated inside end of nozzle.

DIMENSIONS.—
Diameter 9.38 in. (23.8 cm.).
Overall length 54.6 in. (138.6 cm.).

WEIGHT.—
236 lb. (107 kg.).

PERFORMANCE.—
Rated thrust 4,500 lb. (2,045 kg.).
Rated duration 5 sec.
Total impulse 22,500 lb. (10,215 kg.) per sec.

THE AEROJET MODEL 14AS-1000 Mk. 2 MOD. 3 ROCKET.

TYPE.—Single-chamber JATO rocket motor.

PROPELLANT.—Solid type (ALT-161). Propellant comprising solid fuel and oxidizer moulded into a cartridge secured within the cylindrical chamber. Auto-ignition temperature of propellent in excess of 700°F. (370°C.).

IGNITION.—By electrically-fired black powder igniter requiring 12 volts 25 amps for 0.110 seconds or 24 volts 50 amps for 0.32 seconds using 25 ft. (7.6 m.) for No. 20 copper wire.

INSTALLATION.—Three-position attachment, depending upon the installation on the aircraft. After firing unit may be jettisoned.

STORAGE AND OPERATING LIMITATIONS.—Motors can be fired in any position. Operating and storage temperature range is normally from 0°F. (—17.8°C.) to +130°F. (54.4°C.). Refer to detailed manual of instruction for temperature deviations. Units must be stored vertically, nozzle end up. Storage life—up to two years. After firing, the units may be returned to the manufacturer for reloading.

DIMENSIONS.—
Diameter 10.25 in. (261 mm.).
Overall length 35.4 in. (899 mm.).
Frontal area 0.57 sq. ft. (0.05 m.^{2}).

WEIGHTS.—
Weight empty 115 lb. (52.2 kg.).
Weight loaded 194 lb. (88 kg.).

PERFORMANCE.—
Rated thrust 1,000 lb. (455 kg.).
Rated duration 14 seconds.
Total impulse 14,000 lb./sec. (6.360 kg./sec.).
Specific impulse 186 lb. sec./lb. (84.4 kg. sec./kg.).
Jet velocity 5,635 ft./sec. (1,717 m./sec.).

NOTE.—This rocket motor has been awarded United States Civil Aeronautics Administration approved Engine Type Certificate No. 249 for airline use on Douglas DC-3, DC-4 and DC-6, and on Convair 240.

THE AEROJET MODEL 12AS-250B JUNIOR JATO.

TYPE.—Single-chamber JATO rocket motor.

PROPELLANT.—Solid type with fuel and oxidizer moulded into a cartridge secured within the cylindrical chamber. Propellant is inert to shock and has an autoignition temperature in excess of 700°F. (370°C.)

IGNITION.—By a squib-initiated igniter which is incorporated in the inside end of the nozzle. The igniter main charge is black powder which is ignited by means of a small electric squib.

INSTALLATION.—Three-point suspension, depending upon the installation on the aircraft.

STORAGE AND OPERATING LIMITATIONS.—Operating and storage temperature range is normally from —40°F. (40°C.) to +150°F. (65.6°C.). The unit may be returned to the manufacturer for reloading and servicing.

DIMENSIONS.—
Diameter 7 in. (17.8 cm.).
Overall length 14 in. (35.5 cm.).

WEIGHTS.—
Weight empty 35 lb. (16 kg.).
Weight loaded 55 lb. (25 kg.).

PERFORMANCE.—
Rated thrust 250 lb. (113.5 kg.).
Rated duration 12 sec.
Specific impulse 170 lb. sec./lb. (77 kg. sec./kg.).
Jet velocity 5,474 ft./sec. (1,668 m./sec.).

NOTE.—The United States Civil Aeronautics Administration has awarded Engine Type Certificate No. 250 to this rocket motor and has also approved attachment brackets for this unit for installation on such aircraft as the Ryan Navion, Republic Seabee, Beech Bonanza and D18S, Ercoupe, Cessna, Luscombe and Stinson

ALLISON

THE ALLISON DIVISION, GENERAL MOTORS CORPORATION.

HEAD OFFICE AND WORKS: INDIANAPOLIS 6, IND.

General Manager: E. B. Newill.

Assistant General Manager and Manager, Aircraft Engines Operations: Harold H Dice.

Director of Engineering: Dimitrius Gerdan.

Manufacturing Manager for Aircraft Engines Operations: Harold R. Laubach.

Allison is at present building three turbojet engine series and one type of turboprop engine. The turbojet engines in production are the J33 centrifugal-flow and J35 and J71 axial-flow. The J71 is a new high-rated engine the performance of which is still classified.

The turboprop engine in production is the T56, which powers the Lockheed C-130 and the Convair C-131C. Variations of this engine are being considered for commercial usage.

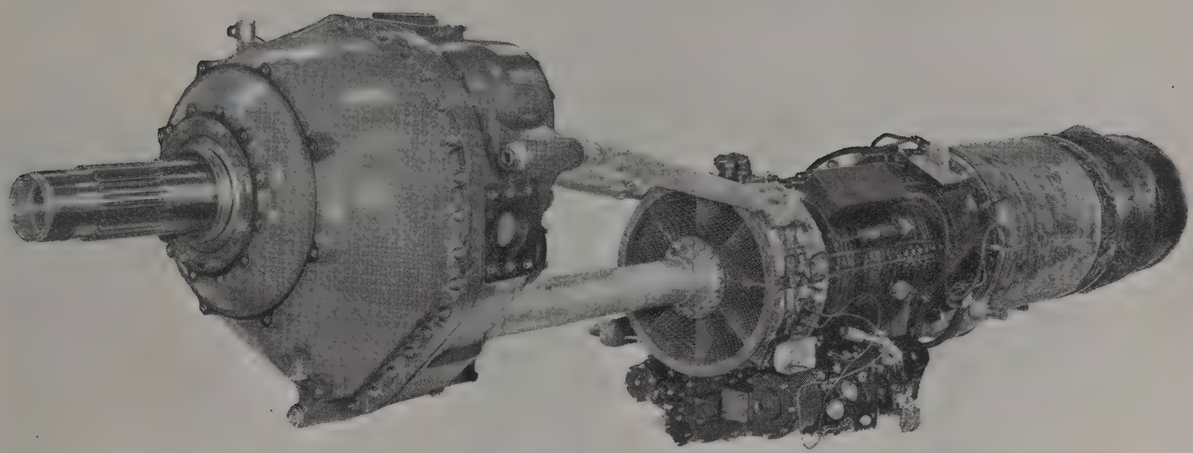
The T40 dual power section turboprop, although no longer in production, powers the Convair R3Y Tradewind four-engined transport flying-boat and the Convair XFY-1 and Lockheed XFV-1 experimental VTO aircraft.

By the beginning of 1955 more than 5¾ million flying hours had been accumulated by Allison turbine engines.

THE ALLISON T56.

TYPE.—Turboprop with 14-stage axial-flow compressor and 4-stage turbine.

PROPELLER DRIVE.—Combination spur/planetary gear type, primary step-down by spur (3.125 : 1), secondary by planetary (4.0 : 1). Overall gear ratio 12.5 : 1. Power section r.p.m. 13,820, propeller shaft r.p.m. 1,106. Cast magnesium reduction-gear housing. Gearbox assembly



The 3,750 e.s.h.p. Allison T56-A-I turboprop engine.

supported from power section by main drive shaft casing 28 in. (71 mm.) long and two inclined struts. Weight of gearbox assembly approximately 450 lb. (204.3 kg.) with pads on rear face for accessory mounting.

Air Intake.—Circular duct on engine face. Thermal de-icing. Inlet air flow 32.5 lb./sec. (14.75 kg./sec.).

Compressor. — Fourteen - stage axial - flow. Series of fourteen discs with rotor blades dovetailed in peripheries and locked by adjacent discs. Rotor assembly tie-bolted to shaft which runs on one ball and one roller type bearings. Fifteen rows of stator blades, welded in rings. Disc rotor and stator blades and casings of stainless steel. Compressor inlet area 155.65 sq. in. (1,004 cm.²). Compression ratio 9.25 : 1. Mass air flow 32.5 lb./sec. (14.75 kg./sec.).

Combustion Chambers.—Six stainless steel cannular-type perforated combustion liners within one-piece stainless steel outer casing. Fuel nozzles in forward end of each combustor liner. Primary ignition by two ignitors in diametrically-opposite combustors.

Fuel System.—High-pressure type. Bendix control system.

Fuel Grade.—Mil-F-5624B Grade JP-4, or Gasoline Grade 100/130.

Nozzle Guide Vanes.—Seventy-eight solid cast GMR-235 steel alloy guide vanes.

Turbine.—Four-stage. Rotor assembly consists of four stainless steel discs, first three with cast GRM-235 blades and the fourth with forged S-816 blades, all secured in peripheries of discs by "fir-tree" roots. Discs splined to rotor shaft which runs on front and rear roller bearings. Steel outer turbine casing. Gas temperature before turbine 1,780°F.

Jet Pipe.—Fixed. Stainless steel.

Accessory Drives.—Accessory pads on rear face of reduction-gear housing at front end of engine.

Lubrication System.—High pressure. Dry sump. Pesco dual-element oil pump. Normal oil supply pressure 180-200 lb./sq. in. (12.6-14 kg./cm.²).

Oil Specification.—Mil-L-7808.

Mounting.—Three-point suspension.

Starting.—Air turbine, gear-box mounted.

Dimensions.—
Width 27.5 in. (698.5 mm.).
Height 40 in. (1,016 mm.).
Length 145.1 in. (3,685.5 mm.).

Weight.—
With accessories 1,645 lb. (746.8 kg.).

Performance Ratings (T56-A-1).—
Take-off 3,750 equivalent s.h.p.
Normal 3,375 equivalent s.h.p.

Consumption.—
Fuel 0.540 lb./h.p. hour (0.245 kg./h.p. hour) at 3,750 e.s.h.p. S/L. static.

THE ALLISON T40.

The T40, which was developed for the U.S. Navy, consists of two axial-flow power sections driving two Aeroproducts three-blade co-axial contra-rotating airscrews through a common reduction gear. The power sections are connected together so that in effect they form a single unit and are connected to the reduction gear by extension shafts. Each power section can operate the contra-rotating airscrews independently or together.

The T40 engine, which is currently rated at 5,850 e.s.h.p., powers the Convair R3Y Tradewind four-engined transport flying-boat which is now in production for the U.S. Navy.

Flight test installations of the T40 engine include those in the Convair XFY-1 and Lockheed XFV-1 experimental vertical take-off aircraft.

THE ALLISON J33 SERIES.

The latest models in the J33 Series o which details are available are :—

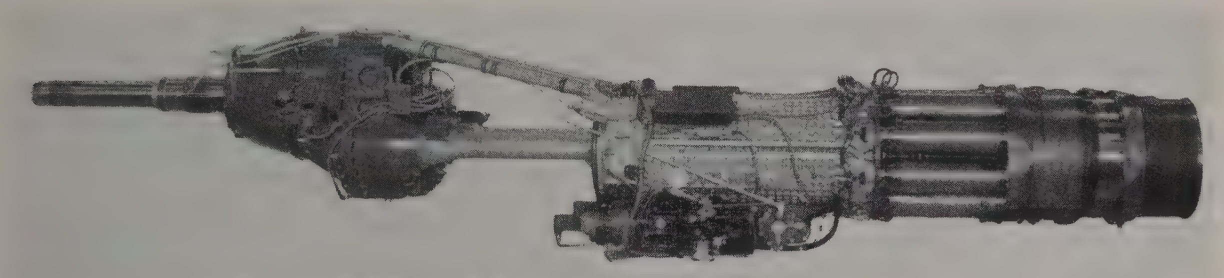
J33-A-16A. Powers the Grumman F9F-7.

J33-A-18A. Powers the Chance Vought Regulus surface-to-surface missile.

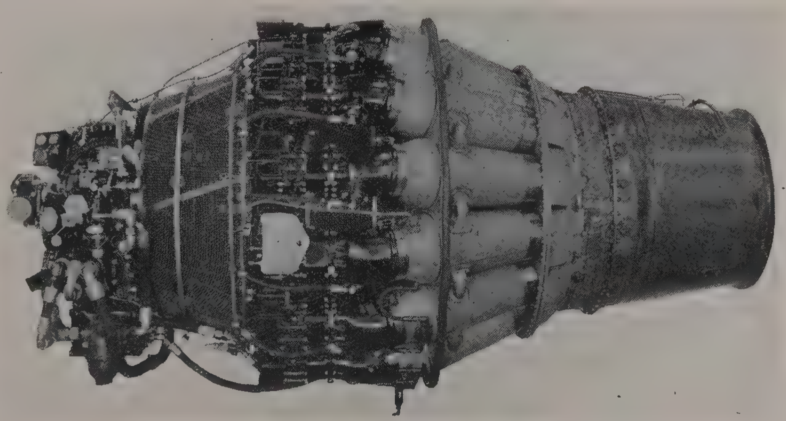
J33-A-22. Powers the Lockheed T2V-1. Has compressor bleeds for airframe boundary-layer control.

J33-A-35. Powers the Lockheed T-33A and TV-2.

J33-A-37. Powers the Martin TM-61 Matador missile. This short-life engine has reduced number of components in accessories section, no air inlet screens and an elongated one-piece exhaust cone-tailpipe. 85% reduction in use of critical materials which, with elimination of components not needed in an expendable engine, results in 30% reduction in cost.



The 5,525 h.p. Allison T40-A-6 turboprop engine.



The Allison J33-A-16A centrifugal-flow turbojet engine.

TYPE.—Centrifugal-flow turbojet.

AIR INTAKE.—Circular air inlet with annular duct leading to impeller eye of compressor. Inlet air flow 87 lb./sec. (39.5 kg./sec.).

COMPRESSOR.—Single-stage double-entry centrifugal-flow, with double-sided impeller having on each side seventeen vanes. Diffuser has fourteen tangential outlets and terminal elbows leading to combustion chambers. Impeller assembly runs on one ball and one roller bearing, the shaft being coupled through flexible spline to turbine shaft. Compression ratio 4.25 : 1. Mass air flow 87 lb. (39 kg.) per sec. at sea level static thrust rating.

COMBUSTION CHAMBERS.—Fourteen straight-through combustion chambers with internal concentrically-mounted perforated flame tubes, each containing at its front end a fuel atomiser. Chambers are interconnected to permit flame spread during starting cycle. Igniter plugs in chambers 7 and 14.

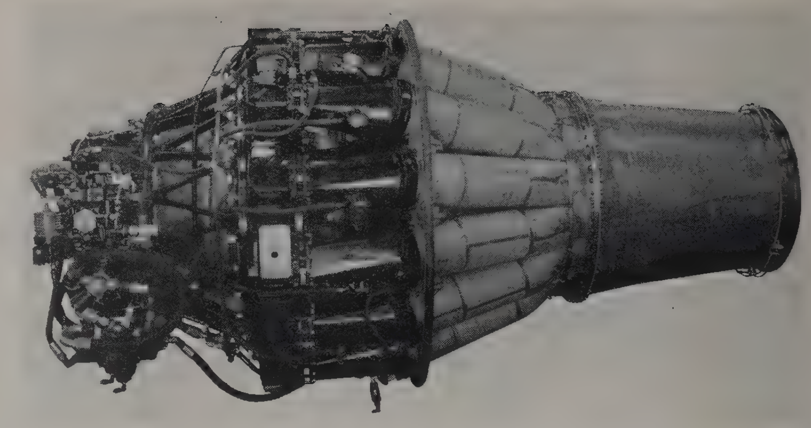
FUEL SYSTEM.—Double manifold type. Pesco dual injection pump delivers fuel to burners through Bendix flow control units. Maximum fuel pressure 40 lb./sq. in. (2.8 kg./cm.^{2}).

FUEL GRADE.—JP-4 (MIL-F-5624) or Gasoline (100/130 Grade).

NOZZLE GUIDE VANES.—Forty-eight cast steel nozzle guide vanes inserted in periphery of steel diaphragm.

TURBINE.—Single-stage axial-flow comprising fifty-four solid alloy steel blades inserted in stainless-steel rotor disc, shaft of which runs on one ball and one roller bearing. Maximum allowable temperature after turbine 1,320°F.

JET PIPE.—Stainless steel jet pipe with fixed inner cone.



The Allison J33-A-18A centrifugal-flow turbojet engine.

DIMENSIONS (J33-A-16A).
Diameter 49.5 in. (1,257 mm.).
Overall length 99.25 in. (2,521 mm.).

DIMENSIONS (J33-A-18A and J33-A-35).—
Diameter 50.5 in. (1,283 mm.).
Overall length 107 in. (2,717 mm.).

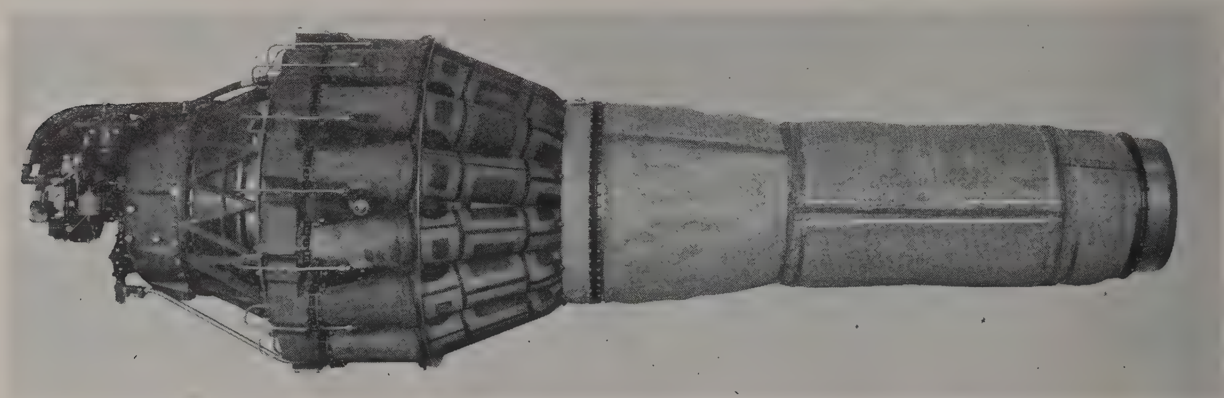
DIMENSIONS (J33-A-37).—
Diameter 49$\frac{5}{16}$ in. (1,252 mm.).
Overall length 159.5 in. (4,051 mm.).

WEIGHTS (Dry).—
S33-A-16A 1,920 lb. (871.6 kg.).
J33-A-18A and J33-A-37 1,790 lb. (812.6 kg.).

CONSUMPTIONS (J33-A-16A).—
Fuel 1.08 lb./hr./lb. s.t. (1.08 kg./hr./kg. s.t.) military, 1.06 lb./hr./lb. s.t. (1.06 kg./hr./kg. s.t.) normal.
Oil 1.2 lb. (0.54 kg.) per hour normal.

CONSUMPTIONS (J33-A-18A).—
Fuel 1.14 lb./hr./lb. s.t. (1.14 kg./hr./kg. s.t.) military, 1.12 lb./hr./lb. s.t. (1.12 kg./hr./kg. s.t.) normal.
Oil 2.2 lb. (1.0 kg.) per hour military, 1.18 lb. (0.53 kg.) per hour normal.

CONSUMPTIONS (J33-A-35).—
Fuel 1.14 lb./hr./lb. s.t. (1.14 kg./hr./kg.



The Allison J33-A-37 "short-life" turbojet engine which powers the Martin TM-61 tactical missile.

AUXILIARY DRIVE.—Engine accessories, including fuel and oil pumps mounted on wheelcase at front of engine.

LUBRICATION SYSTEM.—Wet sump. Gear pump supplies pressure oil to main bearings. Normal oil supply pressure 42 lb./sq. in. (2.95 kg./cm.^{2}). Integral oil tank with capacity for 3 U.S. gallons (11.3 litres).

OIL SPECIFICATION.—Mil-O-6081 (Grade 1010).

STARTING.—Direct-drive electric starter to spin rotating assembly. Igniter plugs in two combustion chambers energised by two Scintilla transformers. Shielded.

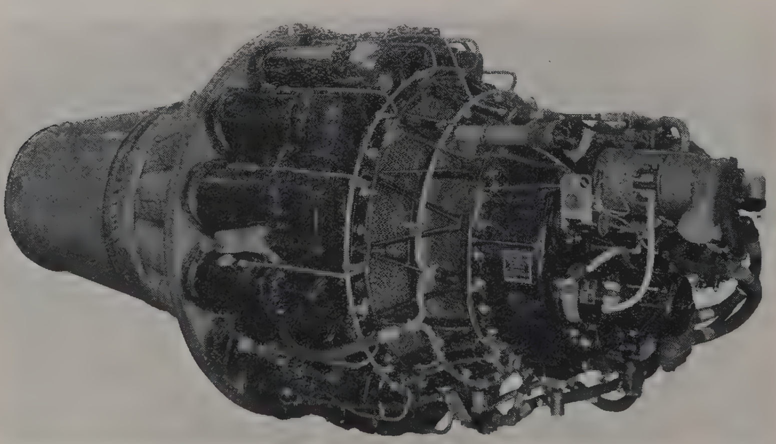
J33-A-35 1,820 lb. (826.3 kg.).

PERFORMANCE RATINGS (J33-A-16A).—
Take-off 6,950 lb. (3,155 kg.).
Military 6,350 lb. (2,883 kg.).
Normal 5,200 lb. (2,360 kg.).

PERFORMANCE RATINGS (J33-A-18A).—
Military 4,600 lb. (2,088 kg.).
Normal 3,900 lb. (1,770 kg.).

PERFORMANCE RATINGS (J33-A-35).—
Take-off 4,600 lb. (2,088 kg.).
Normal 3,900 lb. (1,770 kg.).

PERFORMANCE RATINGS (J33-A-37).—
Continuous max. 4,600 lb. (2,088 kg.).



The Allison J33-A-35 centrifugal-flow turbojet engine.

s.t. take-off, 1.12 lb./hr./lb. s.t. (1.12 kg./hr./kg. s.t.) normal.
Oil 2.2 lb. (1.0 kg.) per hour take-off, 1.8 lb. (0.53 kg.) per hour normal.

CONSUMPTIONS (J33-A-37).—
Fuel 1.14 lb./hr./lb. s.t. (1.14 kg./hr./kg. s.t.).
Oil 2.2 lb. (1.0 kg.) per hour.

THE ALLISON J35-A-35.

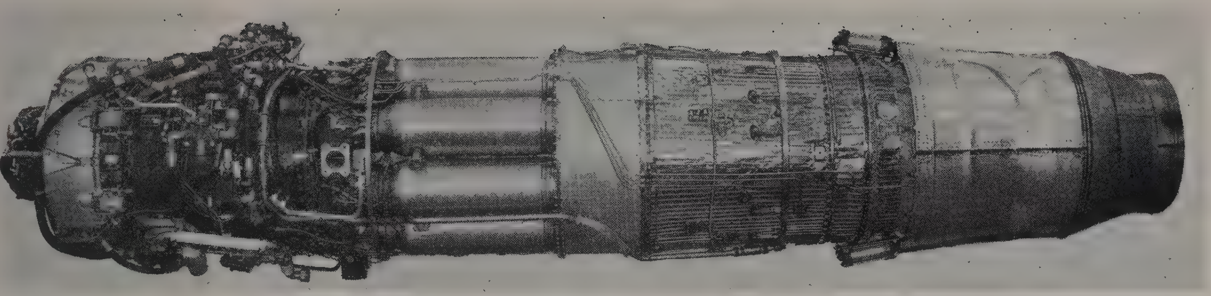
The only engine in the J35 Series still in production is the J35-A-35 which powers the Northrop F-89 Scorpion. This engine is fitted with afterburner, thermal anti-icing, etc.

TYPE.—Axial-flow turbojet.

AIR INTAKE.—Circular intake with annular duct leading to first stage of compressor *via* entry guide vanes. Guide vanes are provided with thermal anti-icing. Retractable inlet screen. Inlet air flow 91 lb./sec. (41 kg./sec.).

COMPRESSOR.—Axial flow having eleven stages. Rotor built up of eleven discs, eight aluminium-alloy and three steel alloys, each disc carrying one row of stainless steel blades. Steel shaft, on to which discs are shrunk and bolted, rotates on one roller and one ball (thrust) bearing. Casing of magnesium-alloy in two sections bolted together, carries twelve rows of steel stator blades. All blades are secured by dovetail roots. Compression ratio 5 : 1. Mass air flow approx. 91 lb. (38.6 kg.) per sec. at T.O. static thrust rating at sea level.

COMBUSTION CHAMBERS.—Eight tubular straight-through stainless steel chambers with internal concentrically mounted perforated flame-tubes each containing at the closed front end a fuel atomiser or burner. Chambers are of stainless steel and flame



The Allison J35-A-35 axial-flow turbojet engine with afterburner.

tubes of Inconel. Igniter plugs in chambers 3 and 6. Chambers are interconnected to permit flame spread at starting and to equalise pressure during normal running.

Fuel System.—High-pressure by-pass system with Bendix fuel control. Max. fuel pressure approx. 300 lb./sq. in. (21.1 kg./cm.^{2}).

Fuel Grade.—Kerosene JP-4 MIL-F-5624 or Gasoline Grade 100/130.

Nozzle Guide Vanes.—Seventy-two stainless steel hollow guide vanes inserted in periphery of stainless steel diaphragm.

Turbine.—Single-stage axial-flow turbine. Disc of stainless steel has 95 GMR 235 alloy steel blades dove-tailed slotted and pinned to disc. Disc is welded to shaft which is carried on two roller bearings one just forward of disc and the other located midway of shaft length. Maximum allowable gas temperature after turbine 749°C.

Jet Pipe and Afterburner.—Stainless steel afterburner casing and jet pipe with variable two-position nozzle. Details of afterburner not available.

Auxiliary Drives.—Engine accessories mounted on accessory case at front of engine.

Lubrication System.—Dry sump pressure system. Two 2-element spur-gear type pumps. Normal oil supply pressure 35 lb./sq. in. (2.4 kg./cm.^{2}).

Oil Specification.—Mil-O-6081-Grade 1010.

Mounting.—Three-point suspension.

Starting. — Direct-drive starter-generator. Igniter plugs in two combustion chambers energised by G. E. transformers.

Dimensions.—
- Diameter (across afterburner) 43 in. (1,092 mm.).
- Overall length including afterburner 195.5 in. (4,965 mm.).

Weight.—
- Dry 2,315 lb. (1,051 kg.).
- Complete with accessories 2,930 lb. (1,330 kg.).

Performance Ratings.—
- Military (with afterburner) 8,000 lb. (3,632 kg.).
- Military (without afterburner) 5,450 lb. (2,474 kg.).
- Normal (with afterburner) 7,200 lb. (3,270 kg.).
- Normal (without afterburner) 4,855 lb. (2,204 kg.).

Consumptions (without afterburner).—
- Fuel 1.10 lb./hr./lb. s.t. (1.10 kg./hr./kg. s.t.) military, 1.08 lb./hr./lb. s.t. (1.08 kg./hr./kg. s.t.) normal.
- Oil shall not exceed 3 lb. (1.36 kg.) per hour, military and normal.

THE ALLISON J71 SERIES.

The J71 is a completely new engine embodying a number of notable changes in design.

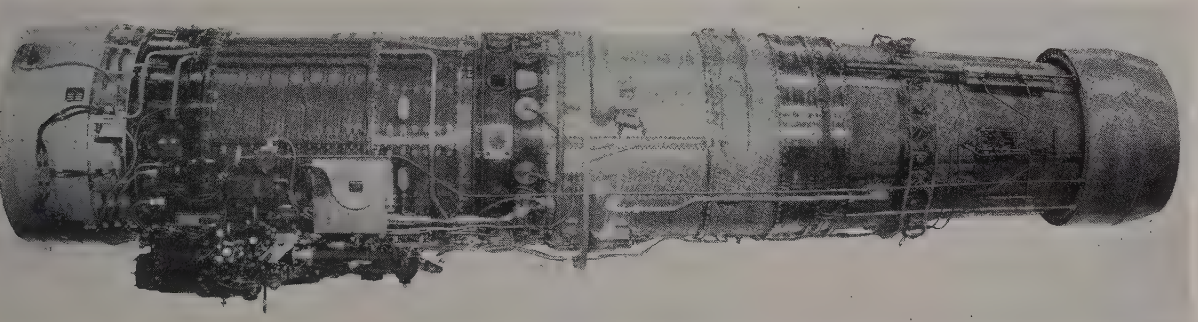
A new combustion system incorporates what Allison calls a "cannular" burner section, in which ten individual combustion chambers are enclosed in a large outer annular type chamber. After compression and ignition in the outer chamber the mixture is bled into the inner "cans" where, in effect, the mixture is re-heated.

The J71 has sixteen stages of compression and a three-stage turbine, and it is fully equipped for all-weather operation. Hot air can be bled from the compressor to the air-inlet vanes and central "bullet" and automatically retractable air inlet screens are provided. An automatic ice-detector is also supplied. The air inlet screens and the variable-area jet nozzle are hydraulically operated by the engine's own independent hydraulic system. It also has its own integral oil system. All further details are classified.

The J71 has passed the official U.S.A.F. qualification test with a demonstrated thrust exceeding 10,000 lb. (4,540 kg.).

The J71 powers the Douglas B-66 bomber and RB-66 reconnaissance bomber (J71-A-9), the McDonnell F3H Demon carrier-based fighter (J71-A-2) and the Martin XP6M-1 Seamaster four-jet swept-wing flying-boat.

All further details are classified.



The Allison J71-A-9 axial-flow turbojet engine with afterburner.

BOEING

BOEING AIRPLANE COMPANY.

Head Office and Works: Seattle 14, Wash.

Officers: See under "Boeing" on page 223.

In 1943, when the U.S. Army Air Forces became interested in the possibilities of using gas-turbines in large aircraft, the Boeing company decided to initiate its own propulsion research programme and a jet-propulsion laboratory was set up in the main plant at Seattle as a pure research project with the object of evaluating all data on gas-turbines. Later, the decision was made to build various turbine components and to evaluate them separately.

Axial-flow and centrifugal compressors and other components were built. Design studies progressed to the point where the original research project was expanded to embrace the complete assembly of experimental power-units, culminating in the design of many other small gas-turbines which are now being built in experimental and production quantities.

The first to run, the Boeing Model 500, is a two-burner turbojet developing 180 lb. (82 kg.) thrust at 36,000 r.p.m. This engine is suitable as a starter engine for larger jets or turbines, and may also be used as a thrust source for missiles, glide-bombs and small aircraft.

The other engines make use of the gas-producing section of the Model 500 and have been adapted for shaft-drive on the Model 502-2E and Model 502-8A, or compressed-air output on the Model 502-7B. The Boeing Model 502-10B gas turbine engine is a further development of the current production engine, the Model 502-2E. Through refinements of compressor and turbine designs and by increasing the pressure ratio of the compressor, the power output has been increased approximately by 40 per cent. and the specific fuel consumption has been decreased approximately by 25 per cent. A further increase in power and decrease in specific fuel consumption is expected before development is completed. The power-section, which has no mechanical connection with the gas-producing section, serves as a gaseous torque converter. Power developed by the gas producer is established by the throttle setting. Load for the shaft-drive engines on the output shaft determines the power-turbine speed and output.

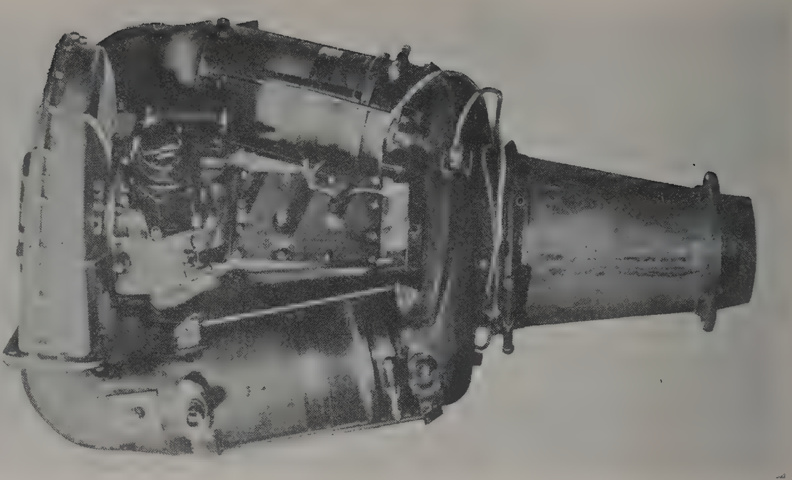
First production contract for the Boeing Model 502 gas turbine engine was received in 1950. An unspecified number of these engines is being produced for the U.S. Navy Bureau of Ships and are being used to supply electrical power for mine-sweeper vessels.

A Cessna XL-19B, the World's first turboprop-powered light aeroplane, which is fitted with the new Boeing Model 502-8B engine, has been under test since November 5, 1952. On July 16, 1953, the XL-19B set up a World's light plane height record of 37,063 ft. (11,304 m.). This turbine-powered light aeroplane

project is a joint development programme of the Cessna and Boeing companies and the U.S. Army and Air Force. The engine is an outgrowth of a joint Boeing—U.S. Navy programme of several year's duration.

A Kaman K-225 helicopter powered with a Boeing 502-2 (YT50) turbine flew for the first time on December 10, 1951, to become the first helicopter in the World in which the rotors are driven by turbine power. A Kaman HTK-1 experimentally powered by two Boeing 502 (T50) engines is the first twin-turbine helicopter.

Tests on the company's ramjets, turbojets and guided missiles have continued.



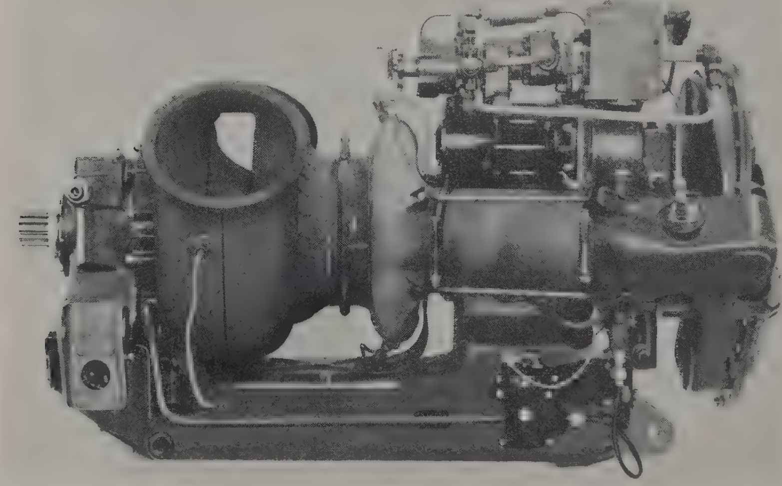
The Boeing Model 500 turbojet which has a thrust rating of 190 lb. (60 kg.).

THE BOEING MODEL 500-2.

Type.—Centrifugal-flow Turbojet.
Air Inlet.—Axial inlet in front of engine. Inlet air flow 3.6 lb. (1.63 kg.) per sec.
Compressor.—Single entry centrifugal compressor. Single-sided impeller with twenty-eight blades, fourteen full and fourteen half. Casing, which incorporates eight log-spiral aluminium-alloy diffuser passages had two tangential outlets and terminal elbows leading to combustion chambers. Compression ratio 3.15 : 1. Mass airflow 3.6 lb. (1.63 kg.) per sec.
Combustion Chambers.—Two cylindrical stainless steel through-flow combustion chambers with internal concentrically mounted Inconel flame-tubes, each containing at its upstream end a Simplex burner.
Fuel System.—Single manifold type. Single lever control which actuates governor-controlled fuel pump delivery to burners. Maximum pressure 400 lb./sq. in. (28.12 kg./cm.²).
Fuel.—Commercially available kerosene, diesel fuel, gasoline or aviation jet fuel.
Nozzle Guide Vanes.—Twenty-seven nozzle guide vanes of Haynes Stellite 27 inserted in periphery of steel diaphragm.
Turbine.—Single-stage turbine. Fifty-five solid Haynes Stellite blades welded to rim of Timken alloy-steel rotor disc. Gas temperature before turbine 1,550°F., after turbine 1,175°F.
Jet Pipe.—Stainless steel sheet jet pipe.
Accessory Drives.—Four gear-driven accessory drive pads at top of gas producer. Fuel pump and governor unit, starter-generator, tachometer and oil pump.
Lubrication System.—Integral with engine except for oil cooler and filter. Oil sump is part of the engine base and has a capacity of 4 U.S. quarts. One Lear-Romec RD-7150A rotary-vane pump with one pressure unit (60 lb./sq. in. = 4.2 kg./cm.²) and one scavenge unit.
Oil Specification.—MIL-0-2104 grade S.A.E. 10.
Starting.—24-volt starter-generator unit in accessory drive. Attachment for air-starting can be supplied if required. Two igniter plugs and two spark coils.
Dimensions.—
Diameter 22.20 in. (559 mm.).
Length (without jet pipe) 29.76 in. (736 mm.).
Length overall 31.70 in. (805 mm.).
Frontal area 3.5 sq. ft. (0.33 m.²).
Weight.—
120 lb. (54.5 kg.).
Performance Ratings (At S/L.—NACA Standard conditions).—
Take-off 195 lb. (88.5 kg.) at 37,500 compressor r.p.m.
Normal or continuous 170 lb. (77.2 kg.) at 36,500 r.p.m.
Consumptions.—
Fuel take-off 1.35 lb./lb. s.t./hr. (1.35 kg./kg. s.t./hr.).
Fuel normal or continuous 1.37 lb./lb. st./hr. (1.37 kg./kg. s.t./hr.).
Oil negligible.

THE BOEING MODEL 502-2E.
U.S. Navy designation: T50.

Type.—Centrifugal-flow Turboprop comprising separate gas producer and power output sections.
Propeller Drive.—Shaft driven by second-stage power output turbine through planetary reduction gear. Gear ratio 8.62 : 1.
Air Intake.—Axial inlet aft. Inlet air flow 3.6 lb./sec. (1.63 kg./sec.).
Compressor.—Same as for Model 500.
Combustion Chambers.—Same as for Model 500.
Fuel System.—Same as for Model 500. Maximum fuel pressure 450 lb./sq. in. (31.5 kg./cm.²).
Fuel Grade.—Diesel fuel, kerosene, gasoline or aviation jet fuel.
Nozzle Guide Vanes.—Fixed. Twenty-seven in both first and second stages.
Turbine.—Two-stage turbine with no mechanical connection between the first (36,000 r.p.m.) and second (25,000 r.p.m.) stages except for shroud and engine frame. Gases from first stage-turbine pass through a nozzle box and are expanded through the second stage turbine which drives the output shaft. Both turbines are alloy steel discs to the rims of which are welded fifty-five (first stage) and forty-four (second stage). Solid alloy blades. Gas temperature before turbine 1,550°F., after turbine 1,175°F. (exhaust temperature).
Jet Pipe.—Annular exhaust manifold with bifurcated outlets to clear reduction gear housing.
Accessory Drives.—Four gear-driven accessory drive pads on gas producer section and two on reduction-gear housing. Fuel pump and governor, starter and starter generator, power turbine governor, and two tachometer generators (one on gas producer section and one on power output section).
Lubrication System.—Integral with engine except for oil cooler and filter. Oil sump is part of the gas producer section and has a capacity for 4 U.S. quarts. One Lear-Romec RD-7150A rotary vane-type pump with one pressure unit (60 lb./sq. in. = 4.2 kg./cm.²) to supply oil to main bearings, accessory drives and reduction gear, and one scavenge unit.
Oil Specification.—MIL-0-2104 S.A.E. 10.
Starting.—24-volt 30-amp. starter-generator unit in accessory drive. Attachment for air starting can be supplied if required.
Dimensions.—
Width 23.2 in. (589 mm.).
Length 39.89 in. (1,013 mm.).
Height 24.43 in. (620 mm.).
Frontal area 3.5 sq. ft. (0.33 m.²).
Weight.—
230 lb. (104.4 kg.).
Rating (At S/L.—NACA Standard condition).—
Max. continuous (static) 175 s.h.p. at 2,900 s.r.p.m. at sea level.
Consumptions.—
Fuel (normal) 1.3 lb./h.p./hr. (0.508 kg./h.p./hr.).
Oil (cruising) negligible.



The Boeing Model 502-2E turboprop engine.

THE BOEING MODEL 502-8B.

The Model 502-8B is basically similar to the previously-described Model 502-2E but has several refinements. It powers the Cessna XL-19B, the World's first turboprop-powered light aeroplane.

Propeller Reduction Gear Ratio.—
10.897 : 1.
Dimensions.—
Width 23.20 in. (589 mm.).
Length 46.83 in. (1,189 mm.).
Height 24.60 in. (625 mm.).
Frontal area 3.5 sq. ft. (0.33 m.²).
Weight.—
267 lb. (121.2 kg.).
Performance Ratings (At S/L.—NACA standard conditions).—
Take-off 210 s.h.p. at 37,500 compressor r.p.m. (2,450 shaft r.p.m.).
Continuous 175 s.h.p. at 36,000 compressor r.p.m. (2,300 shaft r.p.m.).
Consumptions.—
Fuel take-off 1.25 lb./h.p./hr. (0.567 kg./h.p./hr.).
Fuel normal 1.30 lb./h.p./hr. (0.508 kg./h.p./hr.).
Oil negligible.

THE BOEING MODEL 502-10B.

The Model 502-10B is a further development of the Model 502-2E, from which it differs in the following respects :—

Type.—Centrifugal-flow Turboprop.
Propeller Drive.—Gear ratio 8.90 : 1.
Air Intake.—Inlet air flow 4.0 lb. (18.16 kg.) per sec.

COMPRESSOR.—Single-sided impeller with 19 vanes. Compression ratio 4.25 : 1. Mass air flow 4.0 lb. (1.8 kg.) per sec.

FUEL SYSTEM.—Maximum fuel pressure 450 lb./sq. in. (31.63 kg./cm.²).

NOZZLE GUIDE VANES.—Thirty-one first stage and twenty-nine second stage vanes, first stage of Haynes Stellite 30 second stage of AISI Type 310.

TURBINE.—Two stage-axial flow. Two Timken alloy steel discs, first stage welded to and second stage shrunk on shaft. Sixty-six first stage and fifty second stage Haynes-Stellite 31 blades welded to discs. Gas temperature 1,550°F. before and 1,075°F. after turbine (exhaust temperature).

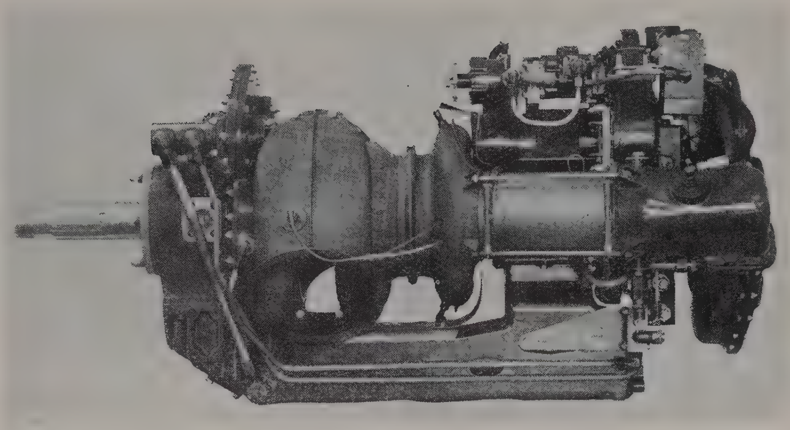
JET PIPE.—Annular exhaust manifold with bifurcated outlets (single outlet optional).

DIMENSIONS.—
Width 22.75 in. (578 mm.).
Height 22.70 in. (576 mm.).
Length of engine 42.83 in. (1.088 mm.).
Frontal area 3.4 sq. ft. (0.315 m.²).

WEIGHT.—
Dry 245 lb. (111.2 kg.).

PERFORMANCE RATINGS (at S/L.—NACA standard conditions).—
Take-off 270 s.h.p. at 37,500 compressor r.p.m. (3,090 shaft r.p.m.).
Continuous 240 s.h.p. at 36,500 compressor r.p.m. (2,920 shaft r.p.m.).

CONSUMPTIONS.—
Fuel take-off 1.0 lb./h.p./hr. (0.454 kg./h.p./hr.).
Fuel continuous 1.02 lb./h.p./hr. (0.463 kg./h.p./hr.).
Oil negligible.



The Boeing Model 502-8B turboprop engine.

THE BOEING MODEL 502-11.

The Model 502-11 is a gas-turbine compressor, the output of which, in the form of compressed air, may be used for in-flight air supply or for the ground servicing of large jet-driven aircraft. A starter unit incorporating this engine has been developed for the Boeing B-52 eight-jet bomber.

The output compressor section incorporates a second axial-flow turbine coupled to a two-stage centrifugal compressor and is joined to the gas producer section by a nozzle ring and shroud. There is no connection between the two sections other than the shroud which confines the flow of gases, and the engine frame which mechanically positions the two sections relative to each other.

CONTINENTAL

CONTINENTAL AVIATION AND ENGINEERING CORPORATION.

HEAD OFFICE AND WORKS: 12700, KERCHEVAL AVENUE, DETROIT 15, MICHIGAN.

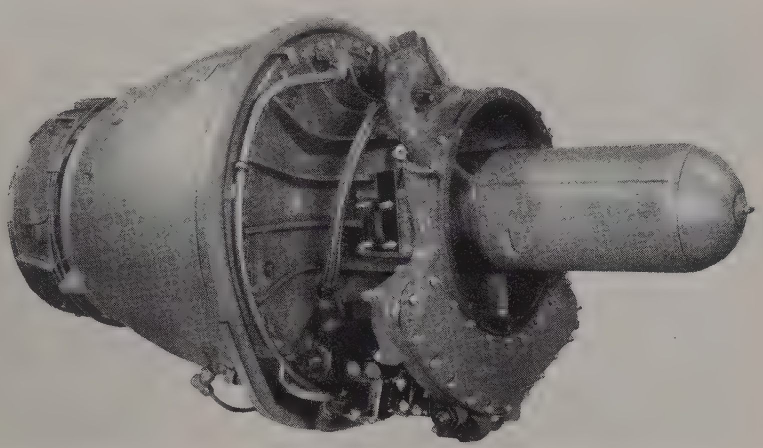
President: C. J. Reese.

Executive Vice-President and General Manager: A. W. Wild.

Secretary: Frederick H. Faust.

Treasurer: H. M. Parker.

Continental Aviation and Engineering Corporation, a subsidiary of Continental Motors Corporation, holds a license to manufacture the French Turbomeca range of gas turbine engines. It is currently engaged in several extensive production programmes for the use of the Marboré II turbojet engine in certain military projects. The American-built Marboré II, which carries the military designation J69 powers the Cessna T-37 twin-jet trainer which is in production for the U.S. Air Force.



The Continental J69 turbojet engine.

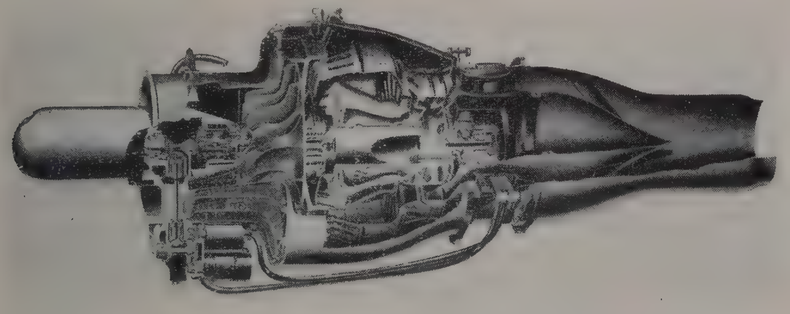
THE CONTINENTAL MODEL 352.
U.S. Air Force designation: J69.

This engine is basically the Turbomeca Marboré II which has been developed to meet American requirements. In its developed form the J69 produces about 4 per cent. more thrust than the French engine. In addition, it has provision for the installation of American accessories of larger types than are used on the Marboré II.

The J69 uses a single-stage centrifugal compressor, an annular combustion chamber and a single-stage turbine. An important feature of the Turbomeca design is the centrifugal method of introducing fuel into the combustion chamber. Fuel is fed into the rotating hollow shaft and is slung into the combustor and burned. The high-speed of the rotating shaft makes for excellent atomisation and burning, eliminating the need for a fuel system of extremely high pressure. The design of the engine permits excellent performance without the use of some of the critical materials ordinarily used in high-temperature components of turbines.

For a general description of the Marboré II see under "Turbomeca" (France).

RATINGS.—
Take-off 920 lb. (420 kg.) s.t. at 22,700 r.p.m.
Normal output 725 lb. (330 kg.) s.t. at 21,000 r.p.m.
90 per cent. normal output 650 lb. (295 kg.) s.t. at 20,300 r.p.m.



A sectioned drawing of the Continental J69 turbojet engine.

FAIRCHILD

FAIRCHILD ENGINE DIVISION, FAIRCHILD ENGINE AND AIRPLANE CORPORATION.

ENGINE DIVISION, HEAD OFFICE AND WORKS: FARMINGDALE, LONG ISLAND, N.Y.

OTHER WORKS: VALLEY STREAM AND MINEOLA, LONG ISLAND, N.Y.

Vice-President and General Manager: George F. Chapline.

Assistant General Manager: E. M. Lester.

Director of Engineering: E. W. Conlon.

Chief Engineer: A. T. Gregory.

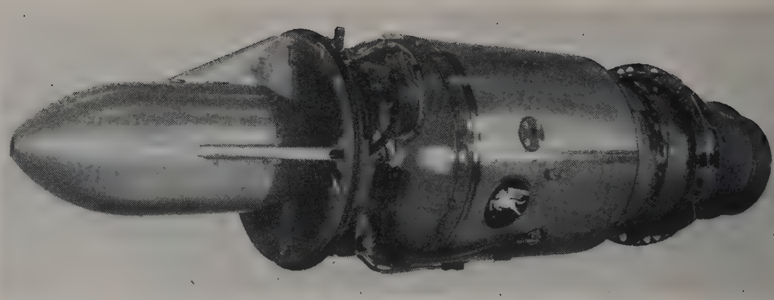
The Fairchild Engine Division is engaged in considerable power-plant research and development work for the Bureau of Aeronautics and the Bureau of Ordnance, Navy Department.

This work includes the development and production of gas-turbine engines for both piloted and pilotless aircraft and guided missiles, and design and development work on a number of other unconventional engines. In addition, Fairchild is producing in quantity major

components of the General Electric J47 turbojet engine and is manufacturing the V-32 D-2 auxiliary power-plant, comprising a reciprocating engine and generator, which is used in virtually every American military aircraft in the bomber and transport classes.

The Engine Division is also engaged in an extensive research and development programme with active contracts from all three branches of the Armed Services. Emphasis in the overall research programme is on the development of specialised power-plants and related components for use on land, on the sea and in the air.

The only recent Fairchild aeronautical product of which brief details may be given is the J44 turbojet which is being produced for both the U.S. Navy and Air Force. It has, however, been announced that Fairchild has U.S.A.F. contracts for the development of an entirely new type of small lightweight high-performance jet engine.



The Fairchild J44-R-20 lightweight turbojet engine.

THE FAIRCHILD J44.

The J44 is a small lightweight turbojet engine which has many possible applications. Primarily it is intended to power target drones and guided missiles, and its first announced use was as the power-plant of the Ryan Firebee high-speed pilotless target aircraft. The Bell VTOL vertical take-off aircraft which first flew in 1954 is powered by two J44 engines, while a Fairchild C-123B has been fitted with two J44 auxiliary jet engines at the wing-tips for evaluation trials.

The J44, which is designed to be a self-contained power-plant needing only a minimum of services from the airframe, features an outer sheet metal monocoque shell which forms both a pressure chamber and a frame structure connecting the two main bearing supports. Its smooth outer shell, which carry the main stresses of the engine, eliminates the need for additional cowling in certain types of installations.

All accessories, including the essential controls and an electric starter-generator, are grouped in a self contained section which can be quickly replaced in the field.

The engine has its own oil storage and requires no oil coolers, pumps or external oil lines. Internal oil capacity for more than ten hours of operation can be provided.

Two mounting methods are available. Due to inherent rigidity, it can be installed without any aft support in a cantilever mounting attaching to the front of the compressor section. It can also be trunnion mounted at the sides of the compressor section with a rear stabiliser at the rear bearing support frame.

Type.—Expendable lightweight turbojet.
Air Intake.—Annular type surrounding nose bullet.
Compressor.—Mixed-flow type. Aluminium centrifugal impellor. Impellor shaft on ball-bearings.
Combustion Chamber.—Annular type. Low-energy ignition system.
Fuel System.—Fixed-orifice fuel nozzles.
Turbine.—Single-stage turbine. Stainless-steel disc bolted to shaft. Forty-six Type ×40 stainless steel blades welded to periphery of disc.
Jet Pipe.—Fixed type.
Accessories. — Self - contained accessory section in nose bullet, containing fuel pump and electrical unit, can be quickly removed or replaced, or individual accessories can be removed from their mounting pads, only one special tool—a shaft-nut wrench—being required for all accessory servicing.
Lubrication. — Oil - mist system. No oil return. Capacity of oil sump 10 oz. (283.5 gr.).
Mounting. — Cantilever ring - mounting at front of engine.
Starting.—Electric or compressed air.
Dimensions.—
Diameter 22.35 in. (56.7 cm.).
Length 88.50 in. (224.8 cm.).
Frontal area 2.72 sq. ft. (0.252 m.²).
Weight.—
Dry, complete 345 lb. (156.6 kg.).
Performance Rating.—
Static thrust 1,000 lb. (454 kg.).

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY. AIRCRAFT GAS TURBINE DIVISION.

Head Office: Cincinnati 15, Ohio.
General Manager: J. S. Parker.
Counsel: C. F. Steele.

Jet Engine Department.
General Manager: G. E. Fouch.
Manager, Engineering: D. D. Streid.

Evendale Operating Department.
General Manager: B. W. Mahoney.

AGT Development Department.
General Manager: D. Cochran.

Small Aircraft Engine Department (Lynn, Mass.).
General Manager: J. S. Parker.

Aircraft Accessory Turbine Department (Lynn, Mass.).
General Manager: W. C. O'Connell.

The General Electric Company entered the gas-turbine field about 1895. Years of pioneering effort by the late Dr. Sanford A. Moss produced the aircraft turbo-supercharger, successfully tested at height in 1918 and mass-produced in World War II for U.S. fighters and bombers.

In October, 1941, by arrangement between the British and American Governments, a complete Whittle W1X engine, a set of drawings of the Whittle W2B, the prototype of the Rolls-Royce Welland engine, and a small team of engineers from Power Jets, Ltd. were flown to America to assist General Electric to initiate the manufacture of turbo-jet engines in the United States.

The first experimental General Electric jet engine was the I-A, a copy of the Whittle W2B. Two I-A's were installed in the Bell XP-59A, the first U.S. jet-propelled aircraft to fly. The first flight of the XP-59A was made in October, 1942, within twelve months of the arrival of the Whittle engine and British engineers in the United States.

The first series production G.E. engine was the I-16, or J31, and this was followed in 1944 by the I-40, or J33, which was chosen to power the Lockheed P-80A Shooting Star. After the war complete responsibility for the J33 was transferred to the Allison Division of General Motors.

The first G.E. axial-flow engine was the TG-180, or J35. Late in 1947 complete responsibility for the J35 design was also transferred to Allison.

General Electric's current production engines are the J47 and J73. J47 engines power the Boeing B-47 and RB-47, North American F-86D, F-86E, F-86F, F-86K, and FJ-2 and the Convair B-36 (wing jet pods). The first installation of the J73 is in the F-86H.

The first turboprop to be designed and tested in the United States, and the first to fly, was the General Electric TG-100, or T31.

In February, 1951, negotiations were initiated between the U.S. Air Force, the Atomic Energy Commission and General Electric for the development of a nuclear power-plant for aircraft. On July 1st, 1951, D. R. Shoults was appointed manager of the General Electric's Aircraft Nuclear Propulsion Project for the Air Force and Atomic Energy Commission. This project is now under way at General Electric's Cincinnati plant.

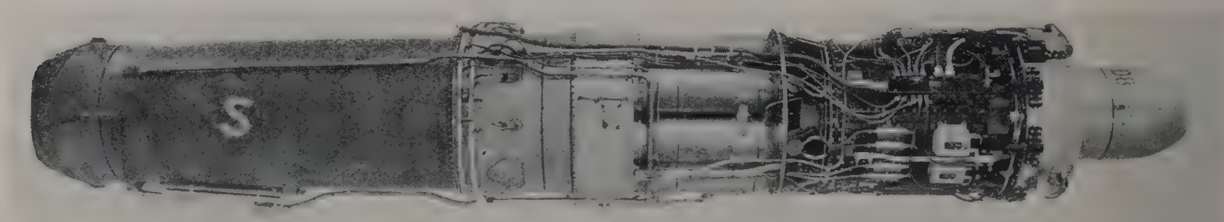
General Electric is still developing and manufacturing turbo-superchargers of various types for maintaining the power of piston engines at altitude.

In 1952 an Aircraft Accessory Turbine Department was established to handle the development, manufacture and sale of aircraft turbine accessory equipment. The new section will market such accessories as gas-turbine starters, turbo-pumps, turbo-superchargers, impellers and air turbine drives. One of the newer products is a small aircraft auxiliary gas-turbine which can start a jet engine without the aid of ground power units.

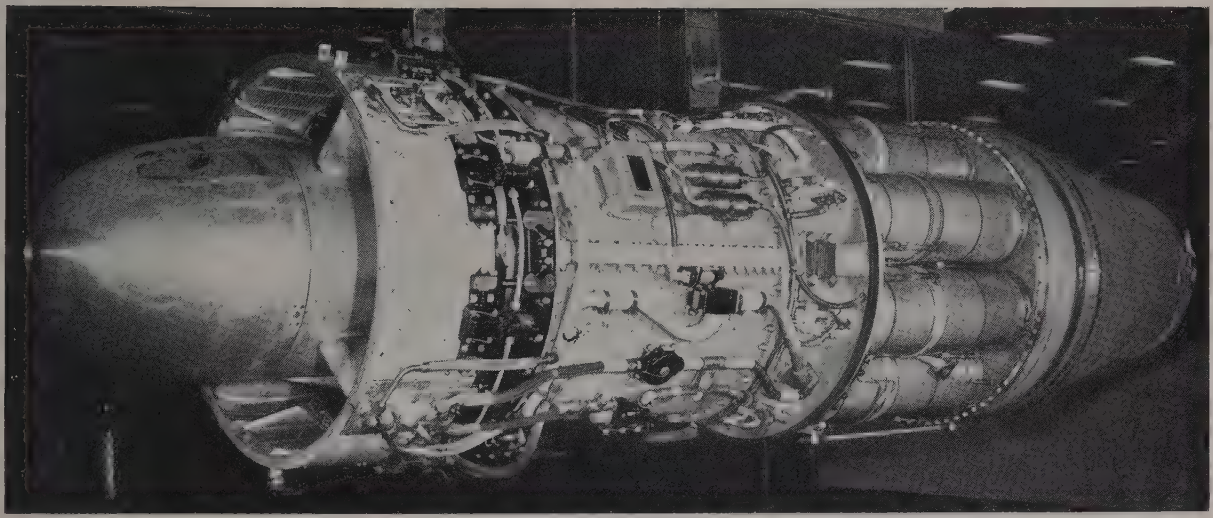
THE GENERAL ELECTRIC XT58.

The XT58 is a small gas-turbine power-unit which has been developed by the company's Small Aircraft Engine Department to meet the requirements of the Bureau of Aeronautics, U.S. Navy.

The engine is intended primarily as a power-unit for helicopters, but can also be used to power small fixed-wing training aircraft in the form of a turboprop or as an auxiliary boost unit for large piston-engined military and commercial aircraft.



The General Electric J47-GE-17 axial-flow turbojet engine with afterburner.



The General Electric J47-GE-25 turbojet engine (5,880 lb.=2,670 kg. s.t. at sea level).

The only indication of its size and power is contained in the inspired statement that it is the size of an automobile engine but is seven or eight times as powerful.

THE GENERAL ELECTRIC J47 SERIES.

The J47 is a development of the J35, the development and production of which is now the responsibility of the Allison Division of General Motors. Although of approximately the same size and weight as the J35, the current production model J47 has a dry thrust rating of 6,000 lb. (2,725 kg.), as compared with 4,000 lb. (1,816 kg.) of its predecessor.

The first installation of the J47 was in the North American F-86A single-seat fighter. In 1948 a standard F-86A established a new World's Speed Record of 670.981 m.p.h. (1,073.5 km.h.).

In 1953 this record was raised to 715.697 m.p.h. (1145.1 km.h.) by a North American F-86D powered by a J47-GE-17 engine with afterburner. Unique in the F-86D are the General Electric automatic electronic engine controls which regulate the fuel flow for best performance throughout all combinations of speed, altitude, engine r.p.m., temperature and other factors affecting engine performance.

The following are some of the models of the J47 installed in current U.S.A.F. aircraft :—

J47-GE-2. Installed in the North American FJ-2 Fury.

J47-GE-11. Installed in the Boeing B-47A and first 87 B-47B.

J47-GE-13. Installed in the North American F-86E and B-45C.

J47-GE-15. Installed in the North American B-45C.

J47-GE-17. Installed in the North American F-86D. Basically the same as the 23 engine except fitted with afterburner; new compressor having higher efficiency and greater airflow; new high-altitude starting system of opposite polarity type; and new electronic controls. Engine is completely anti-iced with hot air bled from compressor to air inlet guide vanes, fairings and support struts. Air inlet screen is retractable after take-off. Considerable reduction in use of strategic materials.

J47-GE-19. Installed in jet-pods of Convair B-36D and B-36F. Same data as -11, -13 and -15 except that this model has high-altitude ignition and starting system.

J47-GE-23. Installed in Boeing B-47B and RB-47B. Basically same as -17 but without afterburner, and hydraulic control instead of electronic.

J47-GE-25. Installed in Boeing B-47E and RB-47E. Rated at over 5,800 lb. (2,630 kg.) dry. Fitted with water/alcohol injection. In production by General Electric and by Packard Motor Company and the Studebacker Corporation to G.E. design.

J47-GE-27. Installed in North American F-86F. Has lower fuel consumption and is anti-iced.

J47-GE-33. Installed in later production F-86F and F-86K.

Type.—Axial-flow turbojet.

Air Intake.—Annular inlet surrounding accessories section, which is enclosed in domed cover. Hollow inlet guide vanes and compressor front frame struts are anti-iced by air tapped from 12th stage of compressor. Retractable air inlet screens for protection in ground running only. Inlet air flow 92 lb. (41.7 kg.) per sec.

Compressor.—Twelve-stage axial-flow. Compression ratio 5.35 : 1. (5.45 : 1 in GE-17). Built up of twelve separate discs, first nine of 14S aluminium alloy and last three of 410 Cr. steel, splined together and secured by axial tie-bolts. Steel rotor blades secured in disc rims by dovetail-type roots. Compressor casing, with dovetail-rooted stator blades, in two halves and bolted together along horizontal centre-line. Compressor shaft carried in bearings supported by front compressor frame and engine mid-frame.

Combustion Chambers.—Eight cylindrical interconnected Inconel chambers with perforated ceramic-coated inner liners. Duplex fuel nozzles in front ends of liners with down-stream injection. Igniter plugs in two chambers. If water/alcohol injection is provided, mixture is injected into chambers through four circumferentially-located nozzles fed from individual manifolds surrounding each chamber, which in turn are supplied from a single manifold surrounding engine.

Fuel System.—Constant-displacement gear-type fuel pump. Hydraulic fuel control system.

Fuel Grade.—JP-1, 2, 3 or 4 Turbofuel, or Mil-F-5572 Gasoline.

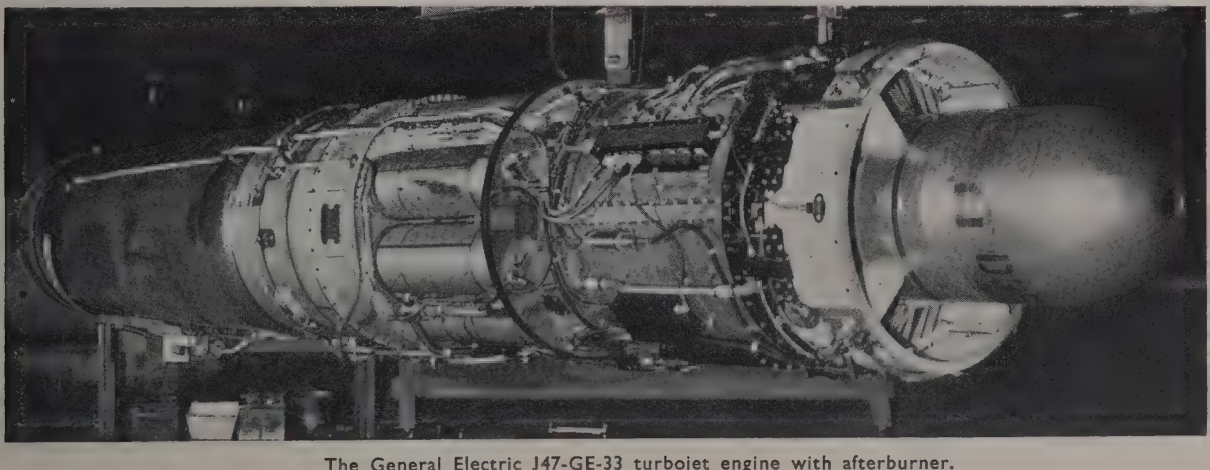
Nozzle Guide Vanes.—64 cast stainless blades welded to inner and outer diaphragm lid" type jet nozzle. Maximum tailpipe temperature 1,275°F.

Turbine.—Single-stage axial flow. Turbine disc of Timken Alloy 16-25-6 stainless steel welded to steel hub. Disc cooled fore and aft by air bled from 8th and 12th compressor stages respectively. Turbine blades of S-816 heat-resisting alloy dovetailed into periphery of disc. Hollow turbine shaft, supported in two bearings, is splined to compressor shaft and locked by through-bolt.

Jet Pipe.—Fixed inner cone and sheet steel outer casing. Afterburner (in J47-GE-17) has automatic control and adjustable "eye-lid" type jet nozzle. Max. tailpipe temperature 1,275°F.

Accessory Drives.—In front compressor frame section and driven through reduction gearing by common drive shaft coupled directly to compressor rotor.

Lubrication System.—Pressure feed to main components with return oil system to bearings and accessory gears.



The General Electric J47-GE-33 turbojet engine with afterburner.

GENERAL ELECTRIC J47 ENGINE DATA.

Engine Model	S/L. Static Thrust (Dry)	S/L. Static Thrust (Augmented)	Normal Thrust	Dry weight with Components	Length with Tailcone	Maximum Diameter	Normal Fuel Consumption
J47-17	5,425 lb. (2,463 kg.) at 7,950 r.p.m.	7,350 lb. (3,337 kg.) at 7,950 r.p.m.	4,490 lb. (2,038 kg.) at 7,790 r.p.m.	3,263 lb. (1,481.4 kg.)	228 in. (5,790 mm.)	36.75 in. (933 mm.)	1.12 lb./lb. s.t./hr. (1.12 kg./kg. s.t./hr.)
J47-23	5,880 lb. 2,670 kg.) at 7,950 r.p.m.	None	4,710 lb. (2,138 kg.) at 7,360 r.p.m.	2,516 lb. (1,142.3 kg.)	145 in. (3,683 mm.)	36.75 in. (933 mm.)	1.017 lb./lb. s.t./hr. (1.017 kg./kg. s.t./hr.)
J47-25	5,970 lb. (2,710 kg.) at 7,950 r.p.m.	6,970 lb. (3,164 kg.) at 7,950 r.p.m.	4,785 lb. (2,172 kg.) at 7,360 r.p.m.	2,554 lb. (1,159.5 kg.)	145 in. (3,683 mm.)	36.75 in. (933 mm.)	1.014 lb./lb. s.t./hr. (1.014 kg./kg. s.t./hr.)
J47-27	5,970 lb. (2,710 kg.) at 7,950 r.p.m.	None	4,785 lb. (2,172 kg.) at 7,360 r.p.m.	2,607 lb. (1,183.5 kg.)	148 in. (3,759 mm.)	36.75 in. (933 mm.)	1.014 lb./lb. s.t./hr. (1.014 kg./kg. s.t./hr.)
J47-2	6,000 lb. (2,724 kg.) at 7,950 r.p.m.	None	4,810 lb. (2,184 kg.) at 7,360 r.p.m.	2,572 lb. (1,167.7 kg.)	148 in. (3,759 mm.)	36.75 in. (933 mm.)	1.011 lb./lb. s.t./hr. (1.011 kg./kg. s.t./hr.)

Mounting.—Four pads on rear compressor frame, two on vertical and two on horizontal centre-line.

Starting.—General Electric 24-volt direct-coupled starter-generator. Two igniter plugs.

Dimensions, Weights and Ratings.—See Table.

THE GENERAL ELECTRIC J73 SERIES.

The J73 Series incorporates a number of new features as compared with the J47 previously described. These include the so-called "cannular" type of combustion system, consisting of a single combustion space containing individual "cans"; a twelve-stage axial-flow compressor and a two-stage turbine; a larger air inlet area achieved by re-locating some accessories below engine; "all-weather" features, including hot-air anti-icing and retractable air inlet screens, etc. Exhaust temperatures are controlled electrically. The oil is cooled by the engine fuel and is contained in a tank on the engine. Either water/alcohol injection or afterburning may be used, and a variable tail-pipe exhaust nozzle may be fitted.

The following engines in the J73 Series have been identified :—

J73-GE-1. Basic J73 engine incorporating features mentioned above.

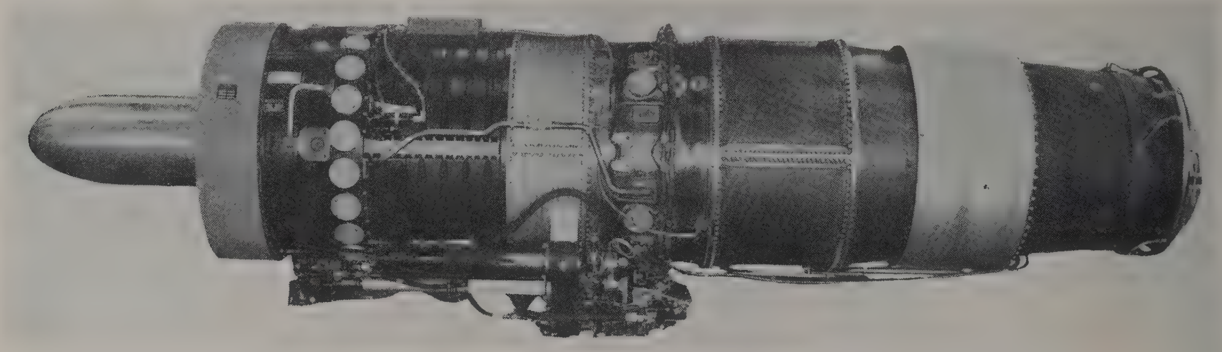
J73-GE-3. Similar to -1 but with modification of accessory mountings and other minor changes. Powers the North American F-86H.

Dimensions.—
Diameter 36.75 in. (933 mm.).
Length 148.2 in. (3,760 mm.).
Frontal area 8.5 sq. ft. (0.79 m.^{2}).

Weight.—
Dry 3,600 lb. (1,635 kg.).

Performance Rating.—
Take-off (static) 9,200 lb. (4,170 kg.).

Consumptions.—
Fuel 0.90 lb./lb. thrust/hr. (0.90 kg./kg thrust/hr.).
Oil 2 lb. (0.90 kg.) per hr. max.



The General Electric J73-GE-3 turbojet engine (9,200 lb. = 4,170 kg. s.t. at sea level).

HILLER

HILLER HELICOPTERS.

Head Office: 1350 Willow Road, Palo Alto, California.

President: Stanley Hiller, Jr.

Vice-Presidents: A. J. M. Chadwick and A. W. B. Vincent.

Chief Engineer: Robert Wagner.

Chief of Propulsion: Elbert Sargent.

Hiller Helicopters began the development of ramjet engines in 1949 after the company had undertaken a study to determine ways of eliminating the costly items of the conventional rotary-wing aircraft. This study showed that the complexity and costs of the present-day helicopter were largely due to the transmission, drive and torque-compensating systems and all the intricate mechanisms of the reciprocating engine. It further showed that if power could be applied to the rotor tips a far more efficient helicopter could be developed.

Hiller began with the development and evaluation of various types of pulse-jet engines but soon concentrated on the simple ramjet, and by August, 1950 had made the first flight with its initial ramjet design in the original Hornet configuration.

Further improved engines were built and tested and in March, 1953, the first successful 200-hour duration test was completed with the 8RJ2B ramjet. The first flight of the HJ-1 type helicopter fitted with two of these tip-mounted power-units was made in September, 1953.

Two further 150-hour endurance tests were made in February and September, 1954, and on October 22, 1954. Type Certificate No. 280 was awarded to the 8RJ2B ramjet engine, the first of its type to be approved by the C.A.A.

Up to August, 1954, 559 helicopter flying hours, 2,104 engine whirl test hours and 1,545 free airjet tests were recorded with the 8RJ2B power-unit.

The Hiller 8RJ2B Ramjet for helicopter rotor-tip installation.

The first civil application of the 8RJ2B ramjet will be in the civil version of the Hornet helicopter which was scheduled for C.A.A. certification during 1955. The 8RJ2B engine already powers the military YH-32 and naval HOE-1 models of the Hornet.

THE HILLER 8RJ2B RAMJET.

The 8RJ2B ramjet is a complete unit intended for helicopter rotor tip mounting. It is comprised of a diffuser, a flame-holder, a combustion chamber and an exit nozzle.

The body of the engine is made up of a series of shell segments formed of thin sheet which are welded to a heavier mounting plate forming the inboard centre section of the engine. This plate which tapers in section to approximately the shell thickness at the welds, provides a thick centre boss to which the blade attachment tab is butt-welded.

The inlet is faired by an inner liner forming a diffusor, and the exit nozzle is reinforced by a thick collar welded to the shell segments. A radial rearward-sloping "finger" type flameholder is located centrally in the aft section of the diffuser. It is made up of an inner segment riveted to the mounting plate and a removable outer segment which is secured to the inner segment by the fuel hub and fairing nut. The fuel nozzle is located at the forward end of the fuel hub.

Dimensions.—
Max. diameter 8.4 in. (21.3 cm.).
Overall length 21.3 in. (54.1 cm.).

Weight.—
12.7 lb. (5.76 kg.).

Performance.—
Equivalent h.p. 45.

MARQUARDT

MARQUARDT AIRCRAFT COMPANY.

Head Office and Works: 16555 Saticoy Street, Van Nuys, California.

President: Roy E. Marquardt.
Executive Vice-President: Robert L. Earle.
Vice-President: George P. Tidmarsh.
Vice-President (Legal and Finance): William H. Schwebel.
Vice-President (Engineering): Don. L. Walter.
Vice-President (Power-plants): John S. Winter.
Chief Engineer (Test Facilities): Leigh E. Dunn.
Chief Engineer (Accessories): Robert L. Goodyear.
Director (Long-range Planning and Research): John A. Drake.

The Marquardt MA-19G subsonic ramjet.

The Marquardt Aircraft Company was formed in November, 1944 to undertake the research and development of subsonic ramjet engines, and at that time it was the only company to be engaged exclusively in this work in the United States.

Testing techniques and facilities were without precedent; manufacturing methods were undeveloped; empirical data on ramjet engine performance and the required knowledge of the high-temperature behaviour of materials were then non-existent. These and many other problems had to be met before early tests proved successful and Government contracts were forthcoming.

The first of these contracts was for the development of a 20-inch diameter subsonic ramjet developing the equivalent of 2,500 horsepower. Then following similar contracts for larger engines of 30 and 48 inch diameters and of proportionally higher thrusts in the subsonic range, as well as for supersonic ramjet engines in varying sizes and types. More than fifty of the 20-inch engines were tested on various piloted aircraft and guided missiles of the U.S. armed forces. The first piloted flight was made with a Lockheed F-80 Shooting Star fitted with a Marquardt 30-inch ramjet at each wing-tip. During flight the normal power-plant of the F-80 was switched off to achieve pure ramjet flight.

The first production order for ramjet engines was awarded for Marquardt 20-inch engines for installation in the U.S. Navy KDM-1 drones being manufactured by the Glenn L. Martin Company. Other accomplishments in the subsonic field are restricted by Government security regulations.

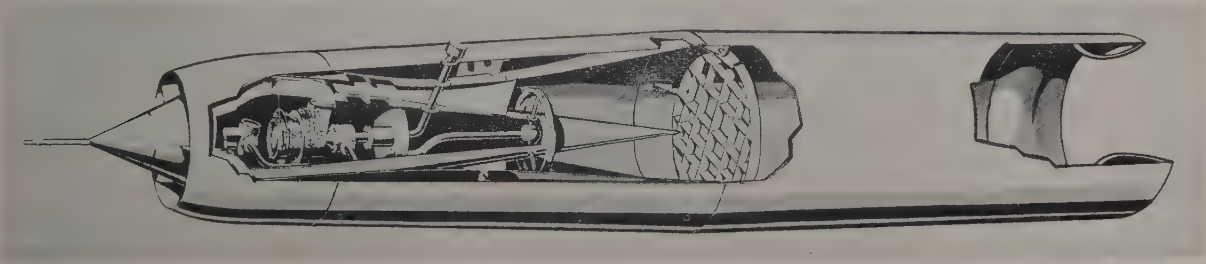
Much of the work done by Marquardt in the field of supersonic ramjets remains under military security, but it can be said that the engines have established records for speed, distance and endurance well up in the supersonic range. Most of these records were established in 1954 under actual flight conditions on missile test-beds. In all cases the supersonic ramjet performed as predicted and in some instances exceeded performance expectations.

The company also develops and manufactures fuel control equipment and air and hydrogen peroxide turbine-driven accessory power-plants to meet the hydraulic, electrical and fuel-pump requirements of ramjet and rocket-powered missiles and turbojet-powered aircraft.

The Marquardt Jet Laboratory is one of the most powerful facilities in the United States for the testing of ramjet and pulsejet engines and related equipment and accessories. It is capable of testing full-scale flight ramjet engines and can simulate speeds approaching 2,000 m.p.h. (3,200 km.h.) and altitudes above 80,000 ft. (24,400 m.).


The Marquardt two-dimensional ramjet for helicopter rotor-tip installation.

During 1954 Marquardt developed for flight testing an "invisible" two-dimensional ramjet engine to supply boost power to helicopters during take-off and hovering conditions. The engine is designed for mounting on the tips of the rotor blades. The ramjets incorporate a unique folding scheme which permits their integration with the rotor blades aerodynamically and structurally. Each engine will produce thrust of 40 lb. (8.16 kg.) at tip speeds of 650 ft. (198 m.) per second. The engine is 16.5 in. (42 cm.) long, 2.5 in.


A sectional drawing of the Marquardt MA-20C 28-inch supersonic ramjet.

(6.3 cm.) thick and 20 in. (50.8 cm.) in span—one of the smallest ramjets ever designed for operational use.

During 1954 Marquardt also developed a new multi-purpose variable-area exhaust nozzle incorporating a reverse-thrust feature. Another feature of the nozzle is its ability to trim in flight to an area which will achieve the minimum specific fuel consumption for the turbojet engine for a given cruise thrust requirement. This feature alone will more than pay for the added weight of the nozzle (less than 100 pounds) in fuel saved and increased range and endurance.

Marquardt is also developing and manufacturing variable-area turbojet exhaust nozzles of advanced design for nearly all of the major engine companies in the United States and Canada.

THE MARQUARDT MA-19G.

U.S. Navy designation : RJ30-MA-6.

Type.—Subsonic Ramjet.

Maximum Exhaust Temperature.—Over 3,000°F.

Dimensions.—
Max. length 87.25 in. (221.6 cm.).
Diameter 20.0 in. (50.8 cm.).

Weight Dry.—
126 lb. (57.2 kg.).

Performance Ratings.—
Max. net thrust 1,450 lb. (660 kg.).
Rated net thrust 1,200 lb. (545 kg.).

THE MARQUARDT TWO-DIMENSIONAL RAMJET.

Type.—Subsonic Ramjet.

Dimensions.—
Length 16.5 in. (42 cm.).
Span 20 in. (50.8 cm.).
Thickness 2.5 in. (6.3 cm.).

Weight Dry.—
4 lb. (1.8 kg.).

Performance.—
Rated net thrust 40 lb. (18.16 kg.).

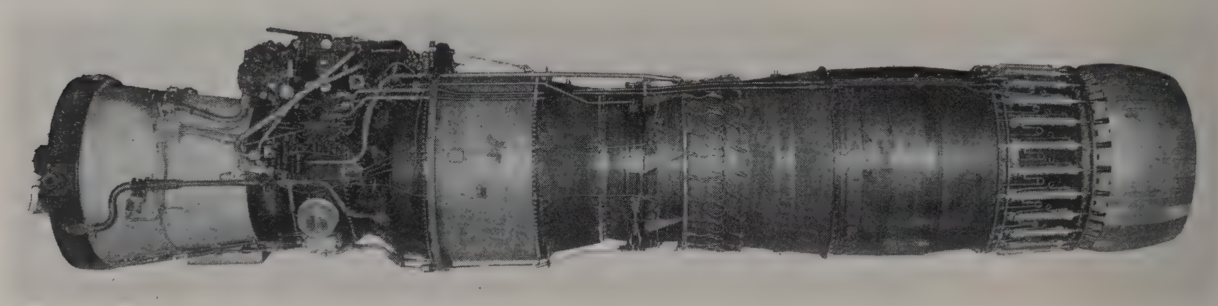
THE MARQUARDT MA-20C.

Type.—Supersonic Ramjet.

Dimensions.—
Max. length 170 in. (432 cm.).
Diameter 28 in. (71 cm.).

Weight Dry.—
490 lb. (222.5 kg.).
(Other details classified).

PRATT & WHITNEY



The Pratt & Whitney J57 turbojet engine with afterburner.

THE PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION.

Head Office and Works : East Hartford 8, Connecticut.

General Manager : William P. Gwinn.

Engineering Manager : Wright A. Parkins.

Chief Engineer : Perry W. Pratt.
Sales Manager : T. E. Tillinghast.
Factory Manager : John L. Bunce.

Pratt & Whitney Aircraft entered the gas-turbine engine field in 1947 by acquiring the American manufacturing and sales rights for the Rolls-Royce Nene engine. These rights were later expanded to include the Rolls-Royce Tay, a development of the Nene. Both these engines have been developed to meet U.S. Navy requirements and to incorporate materials, parts and accessories from United States sources. As the J42 and J48, respectively, they have been produced in quantity to power mainly the Grumman F9F-2 and F9F-5 Panther, the Grumman F9F-6 and F9F-8 Cougar and the Lockheed F-94C Starfire.

Pratt & Whitney Aircraft has been in production with the J57 dual-compressor axial-flow turbojet, the first American engine to be rated in the 10,000-lb. thrust class, since February, 1953. The T34 turboprop engine is also in production.

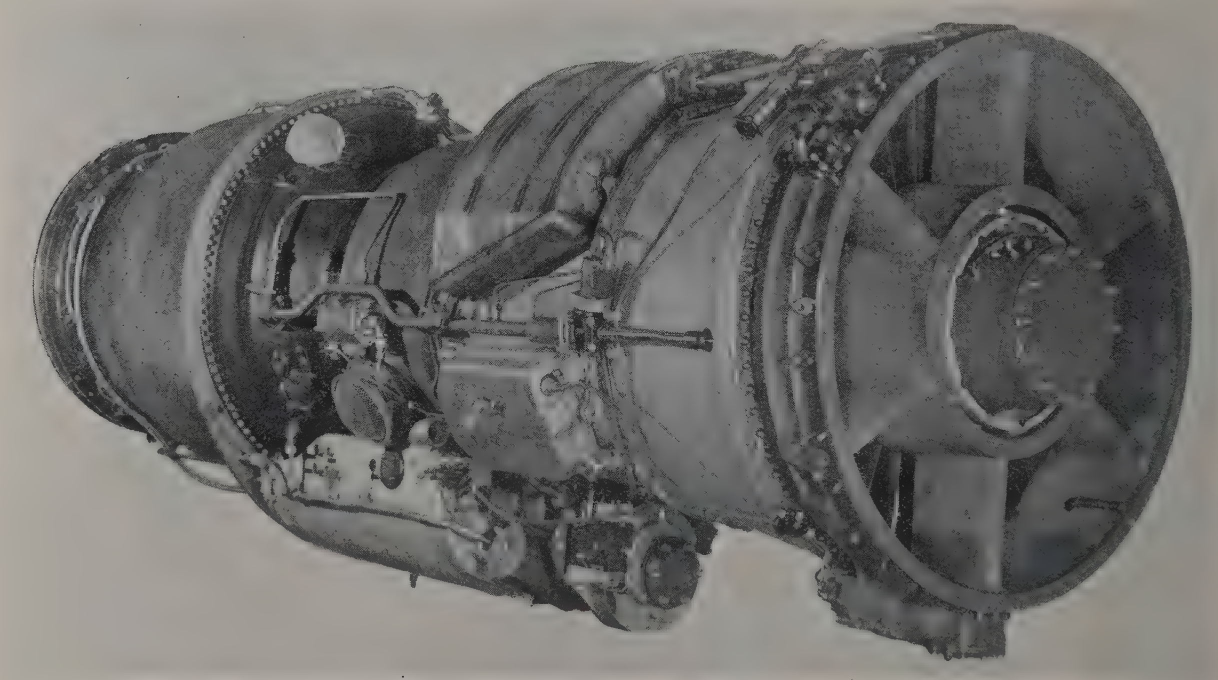
The existence of two new Pratt & Whitney engines—the J75 axial-flow turbojet and the T57 turboprop adaptation of the J57—was revealed in 1954 but for security reasons no information about these engines, both of which were undergoing full-scale testing at the end of 1954, has been released for publication.

In 1954, more that fifty-five per cent. of the power in complete engines built by the company was jet-produced.

THE PRATT & WHITNEY J57.

The J57 is a large axial-flow turbojet engine which is claimed to develop the highest power and to have the lowest specific fuel consumption of any turbojet engine at present in production for the U.S.A.F. It is officially rated as being in the 10,000-lb. thrust class.

The particular feature of the J57 is the two-spool compressor which, in fact, consists of two independent compressors, one high-pressure and one low-pressure mounted in tandem on concentric shafts. The low-pressure compressor and a two-stage low-pressure turbine are on the inner shaft, while the high-pressure compressor and a single-stage high pressure turbine are on the outer shaft.



The Pratt & Whitney J57 axial-flow turbojet engine which develops a thrust of over 10,000 lb. (4,540 kg.).

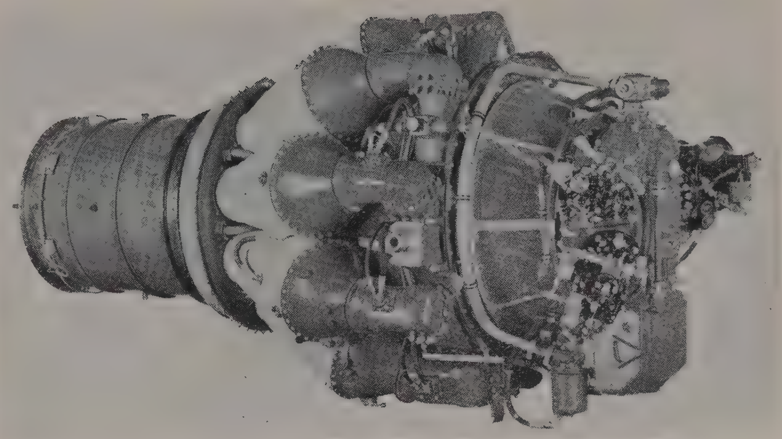
Between the compressor and turbine is the combustion chamber which, in the J57, is of the "cannular" type, comprising an outer annular casing which encloses eight "cans" or flame-tubes.

All other details of the J57, together with dimensions and performance, are classified.

The J57 began its 150-hour qualification tests on September 8, 1952, and the engine went into production in February, 1953. By the Spring of 1955 more than 1,000 J57's had been delivered.

Several models of the J57, both with and without afterburners, are now in production.

The J57 powers the Boeing B-52 eight-jet bomber, the Boeing Model 707 four-jet transport, the North American F-100 supersonic fighter, the Convair F-102 delta-wing fighter, the McDonnell F-101 long-range escort fighter, the Douglas F4D-1 supersonic naval fighter and the Douglas A3D naval attack bomber. By the end of 1954 there were four J57-powered aircraft which had flown faster than sound in level flight. These were the F-100, F-101, F-102 and F4D-1.



The Pratt & Whitney J42-P-8 turbojet engine.

THE PRATT & WHITNEY J48

The J48 is the result of pooling of the engineering talents of two of the World's leading engine builders—Pratt & Whitney Aircraft and Rolls-Royce, Ltd. The basic design is Rolls-Royce, the British version of the J48 being known as the Tay.

The J48 is a development of the J42 which is the Pratt & Whitney-built Nene. A re-designed impeller and larger turbine blades enables the J48 to consume 30 per cent. more air and in turn, to produce more thrust. The J48 is, however, essentially interchangeable with the J42 because dimensional differences are slight. One of Pratt & Whitney's main independent contributions to the J48 is the afterburner.

This engine powers the Grumman F9F-5, F9F-6 and F9F-8, and the Lockheed F-94C.

Although production of the J48 was suspended in 1954 it has since been reinstated on the production line.

Dimensions.—
Diameter 50.5 in. (1,283 mm.).
Length (without fixed nozzle) 109.75 in. (2,788 mm.).

Weight Dry.—
2,080 lb. (944 kg.).

Performance Ratings.—
Take-off (and Military) rating 7,250 lb. (3,290 kg.) s.t.
Normal rating 5,600 lb. (2,540 kg.) s.t.
Cruise rating 3,750 lb. (1,700 kg.) s.t.

Fuel Consumptions.—
At take-off output 1.14 lb./lb. s.t./hr. (1.14 kg./kg. s.t./hr.).
At normal output 1.12 lb./lb. s.t./hr. (1.12 kg./kg. s.t./hr.).
At cruise output 1.14 lb./lb. s.t./hr. (1.14 kg./kg. s.t./hr.).

THE PRATT & WHITNEY T34

The T34 is a single-unit high-pressure axial-flow turboprop engine, the active development of which was begun in June, 1945 under the auspices of the U.S. Navy Bureau of Aeronautics as part of the Navy's overall programme to develop this type of power-plant. A T34 engine completed a 50-hour flight rating test at 5,700 h.p. and flight testing in the nose of a Boeing B-17 began in August, 1950.

In December, 1951, the T34 completed a 50-hour pre-flight test at a rating of 5,500 h.p. e.s.h.p. with a specific fuel consumption that compared favourably with that of piston engines in the highest power ratings.

The T34 has a 13-stage axial-flow compressor with an annular type burner and a three-stage axial-flow turbine. Stainless steel is used almost exclusively in the construction of the T34.

The propeller reduction gear is flexibly coupled to the front of the compressor shaft and the compressor and turbine are rigidly coupled at the rear of the compressor case. The reduction gear uses two stages and operates at a 11 : 1 ratio.

The engine incorporates a mechanical control system in which a single lever is linked to mechanical controls that automatically control the fuel flow and coordinate it with propeller speed, flight speed and altitude for the particular power selected by the pilot.

De-icing is accomplished by hot air bled from the engine to the air inlet area.

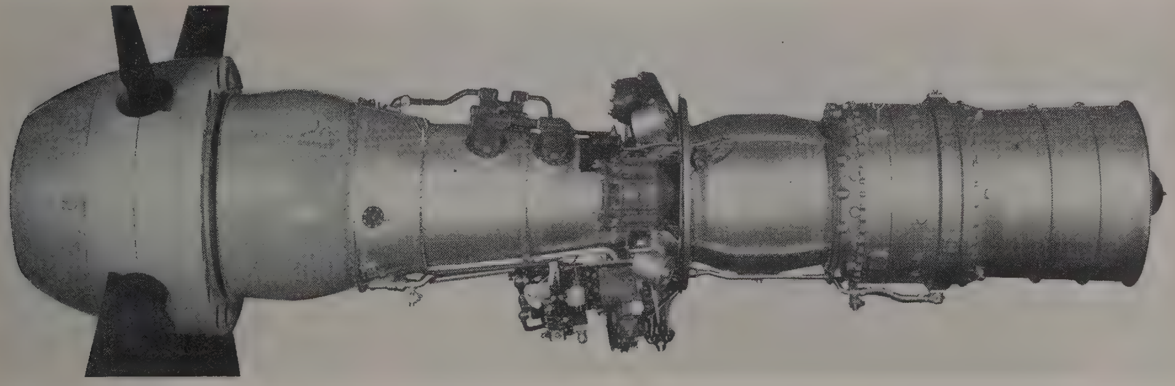
The T34 powers two U.S. Navy Lockheed R7V-2 Super-Constellations in a programme designed to test the potentialities of turboprop-powered transports. A Douglas YC-124B and a Boeing XC-97J, both fitted with four T34 engines are being used for a similar purpose by the U.S.A.F.

Dimensions.—
Max. diameter 34.06 in. (865 mm.).
Max. length 156.8 in. (3,983 mm.).

Weight Dry.—
2,590 lb. (1,176 kg.).

Performance Ratings.—
Take-off output 5,500 s.h.p. plus 1,250 lb. (567.5 kg.) jet thrust.
Military rated output 5,300 s.h.p. plus 1,250 lb. (567.5 kg.) jet thrust.
Normal rated output 4,750 s.h.p. plus 1,125 lb. (511 kg.) jet thrust.
Cruising output (80% normal rating) 3,800 s.h.p. plus 1,000 lb. (454 kg.) jet thrust.
Cruising output (60% normal rating) 2,850 s.h.p. plus 875 lb. (427 kg.) jet thrust.

Fuel Consumptions.—
At take-off power 0.630 lb. (0.286 kg.) per equiv. s.h.p./hr.
At military power 0.635 lb. (0.288 kg.) per equiv. s.h.p./hr.
At normal power 0.655 lb. (0.297 kg.) per equiv. s.h.p./hr.
At cruise (80% power) 0.70 lb. (0.318 kg). per equiv. s.h.p./hr.



The Pratt & Whitney T34 turboprop engine which has a rating of 5,500 e.s.h.p.

RMI

REACTION MOTORS, INC.

Head Office, Works and Laboratory: Rockaway, New Jersey.

President and General Manager: Raymond W. Young.

Executive Vice-President and Assistant General Manager: Henry H. Michaels, Jr.

Executive Assistant: Robert S. Kinsey.

Manager of Engineering and Research: William P. Munger.

Manager of Manufacturing: Joseph W. Mollek.

Manager of Customer Relations and Contracts: Warren P. Turner.

Secretary and General Counsel: Alexander L. Keys.

Treasurer and Assistant Secretary: James W. Fay, Jr.

Reaction Motors, Inc. designed and built the first rocket-type power-unit for aircraft use to be developed in the United States. This engine, which carries the designation 6000C4, operates from the

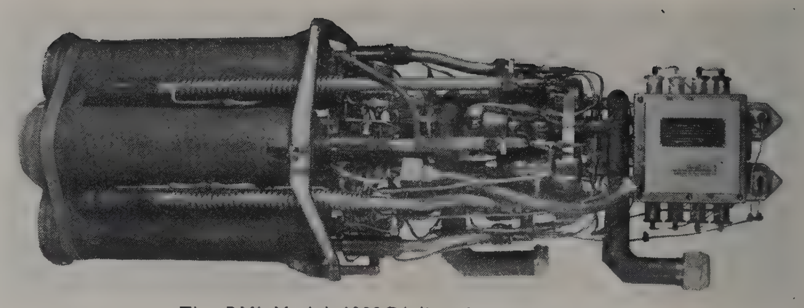
controlled combustion of a fuel (alcohol-water mixture) and an oxidizer (liquid oxygen), which are brought together in four steel cylindrical combustion chambers and expansion nozzles, of which any one or all can be operated at the same time. On a basic weight of 210 lb. (95.3 kg.) the engine develops a maximum thrust of 6,000 lb. (2,725 kg.).

The first practical application of this unit was in the Bell X-1, which was the first American aircraft to exceed the speed of sound.

Subsequent advanced models of the 6000 Series engine powered the Douglas D-558-2 Skyrocket; the Republic XF-91; and the Bell X-1A which has flown at a speed of over 1,650 m.p.h. (2,640 km.h.) and has reached an altitude of over 90,000 ft. (27,450 m.). RMI rocket engines, also power the Martin Viking high-altitude research rocket and the Fairchild Lark and Convair MX-744 missiles. In May, 1954 a Viking powered by a RMI 20,000 lb. thrust rocket engine ascended to an altitude of 158 miles (253 km.) and achieved a speed of approximately 4,300 m.p.h. (6,880 km.h.).

During 1954, Reaction Motors, under a U.S. Navy contract incorporated many improvements in the 6000 Series engine and developed one version with a much higher rated thrust. Also during 1954 the company announced the first application of rocket power to an operational-type helicopter. This ROR (Rocket on Rotor) system was installed in a Sikorsky HRS-2 helicopter for evaluation by the U.S. Marine Corps.

Several engineering programmes devoted to the design of advanced rocket engine systems and components and to the improvement of rocket engine ignition and combustion characteristics are in hand, while various ways of improving the characteristics of present liquid rocket propellants are under investigation and new propellants are being studied and evaluated. The major work currently in hand is of a classified nature.



The RMI Model 6000C4 liquid rocket motor.

THE RMI 6000 SERIES ROCKET MOTOR.

Type.—Liquid bi-propellant Rocket.

Construction.—Chrome-molybdenum steel girder frame supports the combustion chambers, fuel supply and control system, and includes centrally-disposed transverse frame for attachment to airframe. Stainless steel tubular combustion chambers have closed front ends and venturi-type expansion nozzles.

Propellant.—Ethyl alcohol (fuel) and liquid oxygen (oxydiser) are injected into front end of combustion chambers under pressure supplied by helium gas or pressurised nitrogen and ignited. Four control valves each in fuel and oxydiser lines to ensure uniform pressure at entry to chambers.

Ignition.—Separate igniter in each chamber. Igniter uses fuel/oxydiser mixture which is fired by B.G. igniter plus and Eclipse coil. Electrically operated from control box on front of engine. Chambers can be fired individually, in any combination or all together.

Cooling.—Regenerative. Fuel before injection is circulated through coolant passages in exhaust nozzles and around combustion chambers.

Mounting.—Four circumferentially-located mounting points on main frame.

Dimensions.—
Diameter 19.0 in. (48.26 cm.).
Length 56.0 in. (142.24 cm.).
Frontal area 2.0 sq. ft. (0.186 m.^{2}).

Weights.—
Weight dry 210 lb. (95.34 kg.).
Weight/thrust ratio 0.035 lb./lb. thrust (0.035 kg./kg. thrust).

Performance.—
Max. rating 6,000 lb. (2,725 kg.) thrust at any altitude.
Jet velocity 6,182 ft. (1,885.5 kg.) per sec.
Specific impulse 192 sec.
Propellant consumption 0.0052 lb./lb. thrust/sec.

THE RMI ROR SYSTEM.

The ROR (Rocket on Rotor) system is, in fact, an auxiliary power system for helicopters to provide extra power for a relatively short duration of time during vertical take-off before transition to forward flight.

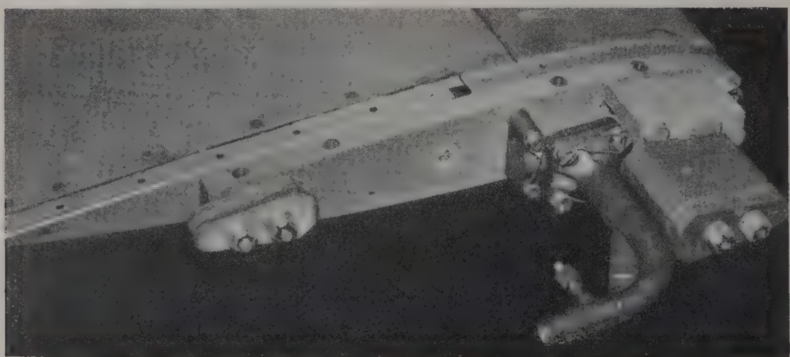
The system involves the use of small rocket engines in the tip of each rotor blade. Such a system has been flight-tested in a U.S. Marine Corps HRS-2 helicopter and has shown the following results:—(*a*) provided approximately 20 per cent. boost in power at sea level; (*b*) made possible take-off with up to 100 per cent. more payload from sea level to 5,000 ft. (1,525 m.); (*c*) increased hovering ceiling under all load or altitude conditions; and (*d*) extended the gliding range by a factor of 3 to 4 with the primary power-plant inoperative.

A typical system, as used in the HRS-2 helicopter, consists of three blade-tip-mounted rocket engines producing a total of approximately 120 h.p., a hub-mounted propellant tank, and a set of simple valves, lines and controls. The whole ROR system weighs 67 lb. (30.4 kg.) dry.

The rocket engine, which is enclosed within a rotor-tip fairing, operates by the rapid catalytic decomposition of 90 per cent. hydrogen peroxide, a mono-propellant. Each individual engine weighs about 1 lb. (0.45 kg.) and provides 40 lb. (18.1 kg.) of thrust, or about 40 h.p. at rotor r.p.m. Feed for the engine is accomplished by the pumping action of the rotor.

A hub-mounted propellant tank, shaped as a modified aerodynamically clean hemisphere, carries up to 300 lb. (136.2 kg.) of fuel, enough for 6 minutes of operation at full power.

There are two simple control elements; a master arming switch and a simple on-off firing switch which actuates all three rocket engines at once. Engines are pre-calibrated to provide, automatically, balanced thrust at each blade tip.



The RMI ROR helicopter rotor-tip auxiliary rocket motor.

WESTINGHOUSE

WESTINGHOUSE ELECTRIC CORPORATION, AVIATION GAS TURBINE DIVISION.

Head Office and Works: Kansas City, Missouri.

Division Manager: W. W. Smith.
Manufacturing Manager: S. F. Chalupa.
Chief Engineer: A. Chilton.
Director of Research: R. P. Kroon.
Sales Manager: R. Soucek.
Manager, Kansas City Plant: S. S. Stine.

The Westinghouse Electric Corporation began the development of aviation gas turbines in December, 1941, at the request of the U.S. Navy Bureau of Aeronautics.

The first Westinghouse jet engine, designated X19A, was the first turbojet engine in the United States to be developed exclusively from American design efforts. It was completed in March, 1943.

Among the several models since produced by Westinghouse are the J30 and the J34 engines and their several variations. The production J30 engine formed the power-plant of the McDonnell FH-1. The production J34, an enlarged version of the J30, powers a number of U.S. Navy fighter aircraft including the McDonnell F2H and Douglas F3D.

The latest Westinghouse engines are the J40 and J46, brief details of which appear hereafter.

In 1953 a ten-year agreement was signed between Westinghouse and Rolls-Royce, Ltd., of Derby, England, under which the two companies will exchange information on the design, development and production of turbojet engines.

THE WESTINGHOUSE J46.

The J46 was designed as a replacement for the J34 as a power-unit for both single and twin-engined lightweight fighters. The engine passed its 50-hour flight substantiation test in November, 1952, and its 150-hour qualification test in July, 1953.

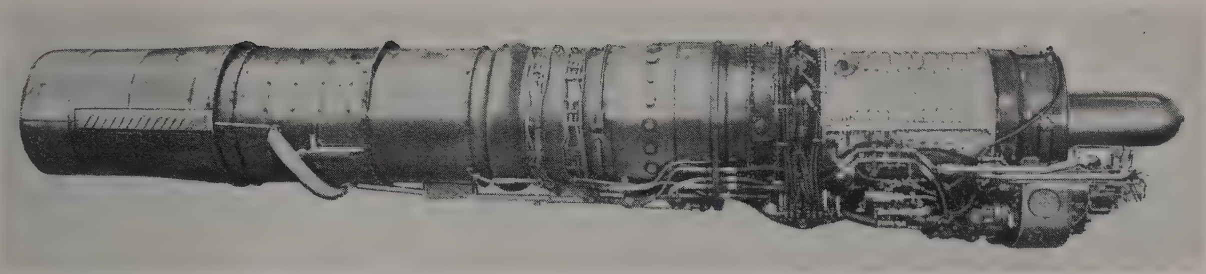
Like all previous Westinghouse engines the J46 features the axial-flow compressor and annular combustion chamber. All other details are classified.

Dimensions.—
Diameter approx. 30 in. (762 mm.).
Length about 198 in. (5.0 m.).

Weight.—
About 2,100 lb. (953 kg.).

THE WESTINGHOUSE J40.

The design of the J40 began in the Spring of 1947 and the first experimental



The Westinghouse J46-WE-8 axial-flow turbojet engine with afterburner.

engine ran for the first time on October 28, 1948. After hundreds of hours of development testing the engine passed its 150-hour qualification test in January, 1951, and was, at that time, the most powerful U.S. turbojet engine to be qualified for production.

The first flight of the J40 engine took place on August 17, 1951, when it took the McDonnell XF3H-1 Demon into the air on its maiden flight.

Using the experience and data gained from the development of the J34 engine, Westinghouse then designed a high-altitude afterburner for the J40. With a slight change in the compressor and the addition of the afterburner the J40 in its new configuration passed the 150-hour qualification test in August, 1952, producing more pounds of thrust per square foot of frontal area than any other qualified American turbojet.

On October 3, 1953, the Douglas XF 4D-1 Skyray powered by a J40-WE-8 engine with afterburner established a new World's Speed Record over the 3-km. course at Salton Sea, California, at 753.4 m.p.h. (1,211.746 km.h.). On October 16, the same aircraft set up a World's Record over a 100 km. closed circuit course on Muroc Dry Lake at 728.1 m.p.h. (1,171.788 km.h.).

Type.—Axial-flow Turbojet.

Air Inlet.—Bifurcated "Y" type with two elliptical inlets separated by wheelcase containing drives for major engine and aircraft accessories. Inlets have thermal anti-icing by air bled from rear end of compressor. Straight-through inlet can be provided for special installations.

Compressor.—Ten-stage axial-flow. Compressor drive made up of ten steel discs with inserted steel blades. Casing in two horizontally split halves, front half of aluminium alloy and rear half of steel. All stator blades of steel.

Combustion Chamber.—Annular chamber of "step-wall" type in which concentric rings admit compressor air to a double annular "basket" type combustion liner containing sixteen duplex spray nozzles with downstream injection.

Nozzle Guide Vanes.—Stationary vanes in turbine section are hollow with forced air cooling.

Turbine.—Two-stage type. Two steel discs bolted together with inserted solid stellite blades.

Jet Pipe (J40-WE-6).—Stainless steel fixed inner cone and outer casing.

Jet Pipe (J40-WE-8).—Afterburner attached to rear end of turbine section by flexible joint and quick-release connections. Fuel injected midway along afterburner casing. Adjustable "eyelid" type jet exit.

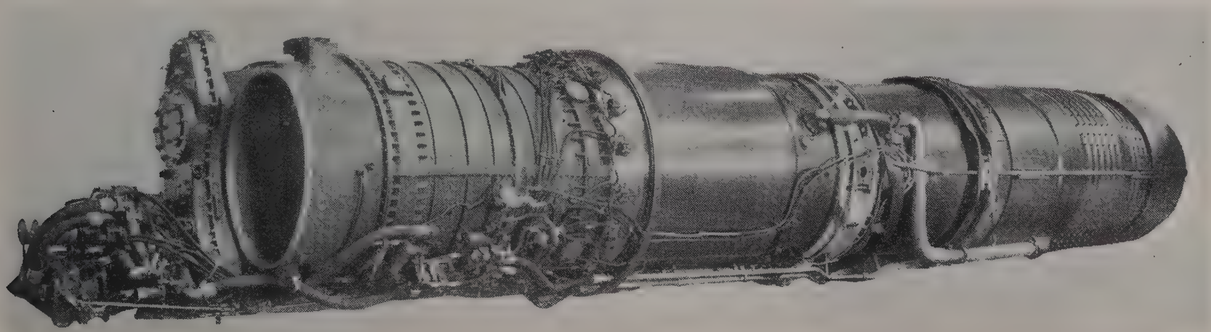
Control.—Electronic automatic control system allows operation of engine from starting to full power and under any condition of flight or altitude with one cockpit lever.

Dimensions—(J40-WE-6).—
Max. diameter about 40 in. (1,016 mm.).
Max. length about 192 in. (4.87 m.).

Dimensions (J40-WE-8).—
Max. diameter about 40 in. (1,016 mm.).
Max. length (including afterburner) about 300 in. (7.62 m.).

Weight Dry.—
Approx. 3,500 lb. (1,590 kg.).

Performance.—
Classified.



The Westinghouse J40-WE-8 axial-flow turbojet engine with afterburner.

WRIGHT

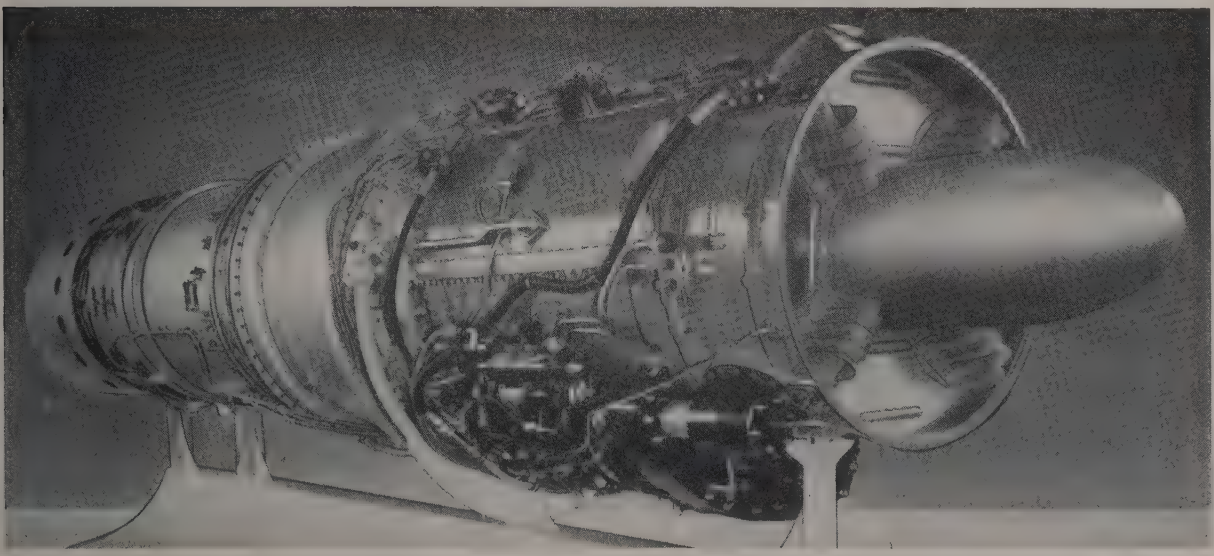
WRIGHT AERONAUTICAL DIVISION, CURTISS-WRIGHT CORPORATION.

Head Office and Works: Wood Ridge, N.J.

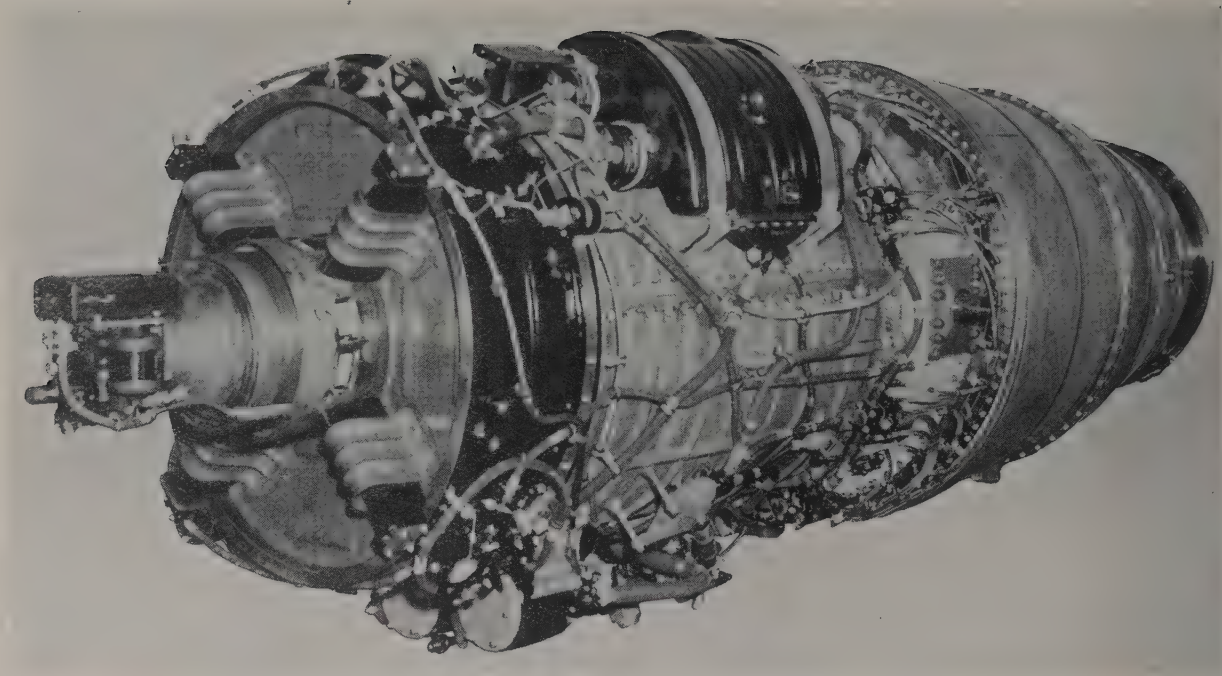
Chairman of the Board and President: Roy T. Hurley.

Vice-President and General Manager: J. V. Miccio.

Vice-President and Chief Engineer: W. G. Lundquist.



The Wright J65 axial-flow turbojet engine with afterburner.



The Wright J65 axial-flow turbojet engine which has a thrust rating of 7,800 lb. (3,540 kg.).

The Wright Aeronautical Division of Curtiss-Wright holds licences for the manufacture of the Armstrong Siddeley Sapphire (J65) and the Bristol Olympus (J67).

Production of the J65 engine was begun in 1951. This engine is installed in the Republic F-84F and RF-84F, the Martin B-57 Canberra, the North American FJ-3 and FJ-4, the Grumman F11F-1, the Douglas A4D, the Lockheed XF-104, etc. It is also earmarked for other advanced military aircraft.

Wright also has two turboprop engines under development, the T47 which is a turboprop development of the J67 and the T49 which is a single-shaft turboprop development of the J65.

In addition to the development of a series of turbojet and turboprop engines, Wright is actively engaged in a ramjet development programme for guided missile applications.

THE WRIGHT J65.

Type.—Axial-flow Turbojet.

Air Intake.—Annular type surrounding front main bearing support.

Compressor.—Thirteen-stage axial-flow, first seven stages forming low-pressure section and last six high-pressure section. Rotor blades secured in steel discs shrunk on hollow aluminium-alloy shaft. First three rows of blades are of steel and secured in discs by "fir-tree" roots. Remaining rows of blades, four of aluminium-alloy and last six of stainless steel, secured between pairs of discs by rivets. One row of inlet guide vanes and all stator blades secured by serrations in carrier rings, which are split for ease of assembly in compressor case. Inlet guide vanes and first seven rows of stator blades are shrouded. Compressor shaft carried on ball-bearing (front) and roller bearing (rear). Compressor casing, an aluminium casting, is split on horizontal centre-line.

Combustion Chamber.—Single annular type with inner and outer stainless steel liners between which combustion takes place. Thirty-six Armstrong Siddeley type fuel-air vaporisers. Fuel and primary air fed into hook-shaped vaporiser tubes whose open ends point upstream. Secondary air enters chamber through 36 air distributing cups to mix with combustion flame near vaporiser tubes.

Fuel System.—Low pressure type.

Fuel Grade.—Mil-L-5624A (JP4).

Nozzle Guide Vanes.—Aerofoil type.

Turbine.—Two-stage turbine. Steel discs coupled together by taper pins. First-stage disc has 110 buckets, second-stage 75 buckets, all secured by "fir-tree" roots and locking plates. Blades of nickel-base alloy. Front turbine disc attached by taper pins to turbine rotor stub shaft. This is splined to turbine rotor shaft coupling, front end of turbine rotor shaft, in turn, being bolted to compressor rotor shaft drive coupling. Roller bearing in front of rotor disc assembly. Gas temperatures 1,476°F. before turbine, 1,112°F. after turbine.

Jet Pipe.—Fixed type. Steel jet pipe and inner cone.

Accessory Drive.—Off extension of compressor shaft in front main bearing support.

Lubrication System.—Closed system. Oil tank (5 U.S. gallons = 18.9 litres capacity) located on upper port side of compressor casing. One gear-type pressure pump, one gear-type scavenge pump and two piston-type metering pumps. Normal oil pressure 20-35 lb./sq. in. (1.4-2.4 kg./cm.^{2}).

Oil Specification.—Mil-L-7808.

Mounting.—Three-point suspension, one stabilising support at front and two trunnions at centre main bearing support on horizontal centre-line.

Starting.—Electric starter/generator in bullet fairing on nose. Primers and igniters in combustion chamber. Electrical and ignition systems interconnected for automatic starting.

Dimensions.—
Diameter 37.75 in. (960 mm.).
Length overall 130.66 in. (3,320 mm.).
Frontal area 7.75 sq. ft. (0.72 m.^{2}).

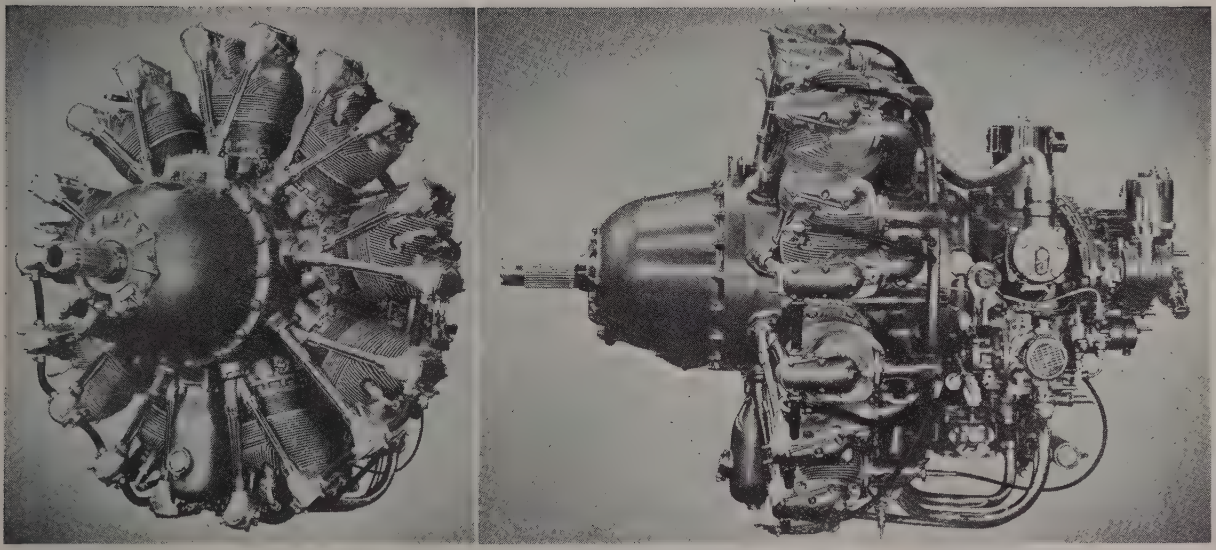
Weights.—
Dry 2,595 lb. (1,178 kg.).
Complete with accessories 2,696 lb. (1,224 kg.).

Performance Ratings.—
Max. static thrust 7.220 lb. (3,280 kg.) (J65-W-2) and 7,800 lb. (3,540 kg.) (J65-W-2) at 8,300 r.p.m.

PART 2—PISTON ENGINES

GREAT BRITAIN

ALVIS



The Alvis Leonides nine-cylinder radial air-cooled engine.

ALVIS LTD.

HEAD OFFICE AND WORKS: HOLYHEAD ROAD, COVENTRY.

Directors: J. J. Parkes, A.F.R.Ae.S. (Chairman and Managing Director), R. W. Rutledge (Deputy Chairman), S. W. Horsfield (Sales Director), H. J. Nixon (Works Director), Lieut.-Col. J. C. Chaytor and Capt. H. S. Harrison-Wallace, D.S.O., R.N. (Retd.).

The Alvis Company has several marks of its nine-cylinder Leonides radial engine in production for commercial and military aircraft, and is also engaged on the development of the fourteen-cylinder Leonides Major, which is scheduled to power the Bristol 173 twin-engined helicopter, the Westland Sikorsky S.55 helicopter, and the Handley Page Herald four-engined medium airliner.

The present Leonides is the result of continuous development over many years, and the engine is the only modern piston engine in its class. The Leonides 503/6 (Mk. 126) is the standard power-plant for the Percival Provost, the basic trainer for the Royal Air Force, and provides continuous power inverted. The Leonides also powers the Scottish Aviation Prestwick Pioneer and Twin-Pioneer.

The helicopter version of the Leonides is the standard power-plant for most British helicopters, and is now in large-scale service with the Royal Air Force and the Royal Navy in the Westland Dragonfly, and with the Royal Air Force and the Royal Australian Navy in the Bristol Sycamore.

THE ALVIS LEONIDES.

TYPE.—Nine-cylinder radial air-cooled, geared and supercharged.

CYLINDERS.—Bore 4.8 in. (122 mm.). Stroke 4.41 in. (112 mm.). Capacity 718.6 cub. in. (11.78 litres). Compression ratio 6.8 : 1. Nitrided steel barrels, which are bolted to crankcase, and cast Y-alloy heads screwed and shrunk on. Both barrels and heads are deeply finned.

PISTONS.—Forged Y-alloy with internal finning below crown. Two compression and two scraper rings, one scraper at skirt rest above gudgeon-pin. Fully-floating gudgeon-pins with washers and circlips.

CONNECTING RODS.—I-section master-rod and I-section auxiliary rods machined from high-grade steel. Master-rod has white metalled steel shell big-end bearing, all other bearings have bronze bushes.

CRANKSHAFT. — Single-throw shaft with divided crank-pin. The divided pin is splined internally for a mating and splined steel coupling. Shaft runs in one uncaged roller bearing and one ball thrust bearing.

CRANKCASE.—Cast in two halves in L.51 alloy.

VALVE GEAR.—Two inclined valves per cylinder with independent rocker system completely enclosed. Both valves of austenitic steel, the exhaust valve sodium-cooled and with "bright-ray" covered head and seats. Two-track cam disc, each track with four cams operating roller followers housed in removable tappet guides in crankcase.

CARBURATION.—Hobson automatic low-pressure fuel injector. Induction system incorporates air-cleaning and de-frosting with oil-heated throttles and throttle housing.

SUPERCHARGER.—Single-speed single-stage centrifugal blower. Supercharger ratio 6.5 : 1.

FUEL.—100/130 Grade (D.E.R.D.2485).

IGNITION.—Two B.T.H. type C.9B/2 (C.9A/3 in Type 521/1 and 523/1 engines) magnetos with fully screened ignition system. Two plugs per cylinder.

LUBRICATION.—Dry sump system. One pressure pump and two scavenge pumps in tandem. Normal oil pressure 60-80 lb./sq. in. (4.2-5.6 kg./cm.^{2}). Inlet temperature (max.) 85°C. Outlet temperature (approx.) 110°C. Normal oil flow 300 gallons (1,364 litres) per hour.

REDUCTION GEAR.—Farman type epicyclic. Gear ratio 0.625 : 1.

AIRSCREW SHAFT.—No. 3 size L.H. rotation. Constant-speed governor unit driven through bevels mounted on front of cam gearing drive-shaft. Operating oil passes through annular channels and drilling in special oil transfer unit located inside stationary bevel of reduction gear.

MOUNTING.—Dynafocal flexible type with four pin-jointed attachments.

COOLING.—Complete pressure baffling and flexibly-mounted close-fitting cowling with hinged panels and electrically-operated gills.

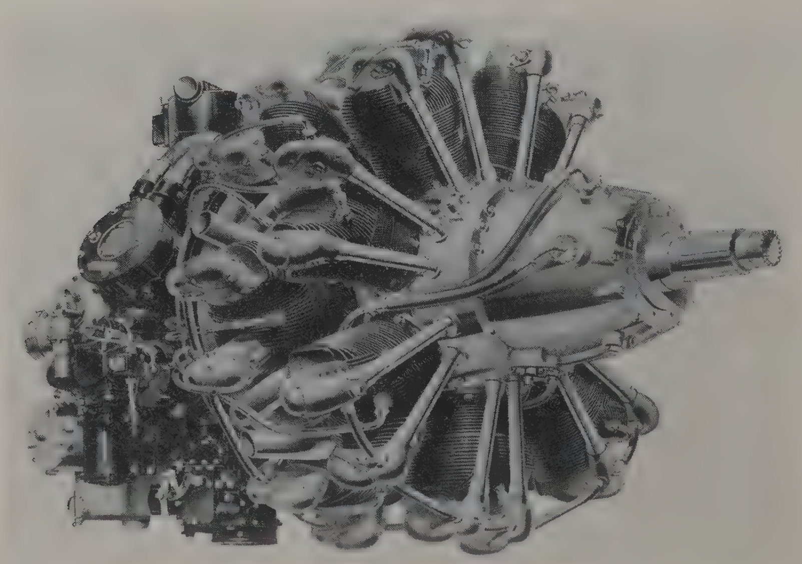
STARTING.—Plessey cartridge, or Rotax hand/electric starter (with feathering pump drive on all engine types except 521/1 and 524/1).

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

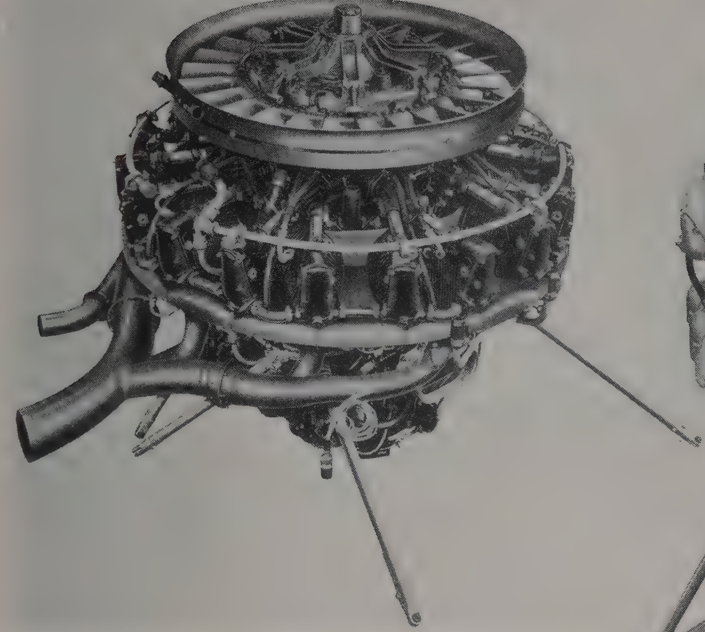
CONSUMPTIONS.—
Fuel (at max. continuous power) 39.25 Imp. gal. (178.5 litres) per hour.
Oil 4 to 9 pints (2.2 to 5.1 litres) per hour.

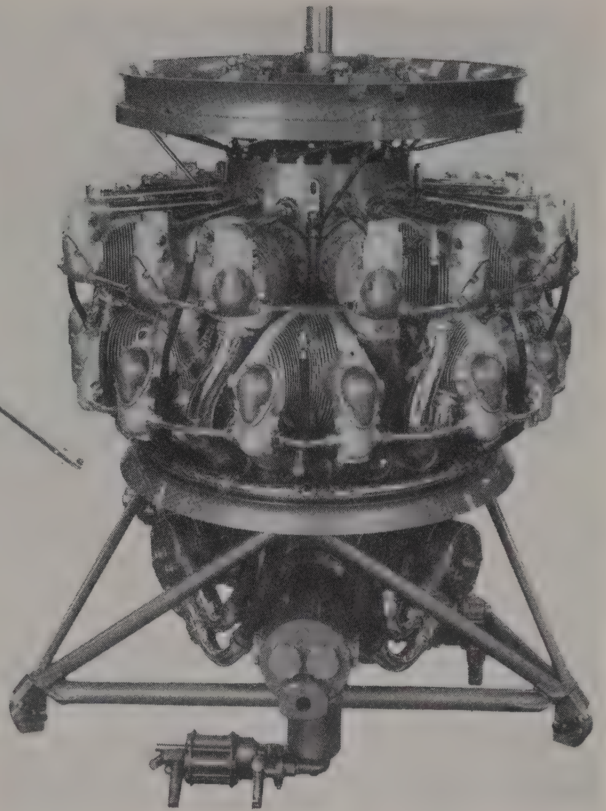
ALVIS LEONIDES AND LEONIDES MAJOR RADIAL AIR-COOLED ENGINES.

Model	Bore and Stroke	Swept Volume	Take-off Power	International Rating	Max. Power Rating	Nett Dry Weight	Reduction Gear Ratio	Dimensions		Accessory Drives
								Diameter	Length	
Leonides 502/2	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	440 h.p. at 7,250 ft. (2,210 m.)	545 h.p. at 1,750 ft. (535 m.)	795 lb. (361 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
502/4	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	440 h.p. at 7,250 ft. (2,210 m.)	545 h.p. at 1,750 ft. (535 m.)	795 lb. (361 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
502/5	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	440 h.p. at 7,250 ft. (2,210 m.)	545 h.p. at 1,750 ft. (535 m.)	800 lb. (363 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
503/5	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	460 h.p. at 6,000 ft. (1,830 m.)	545 h.p. at 1,750 ft. (535 m.)	800 lb. (363 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
503/6	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	460 h.p. at 6,000 ft. (1,830 m.)	545 h.p. at 1,750 ft. (535 m.)	810 lb. (367 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
503/7	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	460 h.p. at 6,000 ft. (1,830 m.)	545 h.p. at 1,750 ft. (535 m.)	810 lb. (367 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
503/8	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	460 h.p. at 6,000 ft. (1,830 m.)	545 h.p. at 1,750 ft. (535 m.)	810 lb. (367 kg.)	.5 : 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
521/1	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	480/500 h.p.	440 h.p. at 6,250 ft. (1,910 m.)	515 h.p. at 3,250 ft. (1,020 m.)	790 lb. (358 kg.)	.8 : 1	41.5 in. (1,054 mm.)	55 in. (1,397 mm.)	Vertical Mounting. Vacuum Pump. Fluid Pump. Air Compressor.
523/1	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	460 h.p. at 6,000 ft. (1,830 m.)	545 h.p. at 1,750 ft. (535 m.)	790 lb. (358 kg.)	.8 : 1	41.5 in. (1,054 mm.)	55 in. (1,397 mm.)	Vertical Mounting. Vacuum pump. Fluid Pump. Air Compressor.
524/1	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	500/520 h.p.	465 h.p. at 6,750 ft. (2,060 m.)	540 h.p. at 4,750 ft. (1,450 m.)	730 lb. (331 kg.)	Nil	41.5 in. (1,054 mm.)	32.8 in. (833 mm.)	Vertical Mounting.
Leonides Major A.Le.M.1-7	4.80 in. (112 mm.) × 4.41 in. (112 mm.)	1,117 cub. in. (18.34 litres)	850 h.p.	635 h.p. at 8,500 ft. (2,590 m.)	860 h.p. at 1,750 ft. (535 m.)	1,200 lb. (545 kg.)	.533 to 1	38.9 in. (988 mm.)	70.9 in. (1,801 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
A.Le.M.1-8	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	1,117 cub. in. (18.34 litres)	850 h.p.	860 h.p. at 1,500 ft. (457 m.)	860 h.p. at 1,500 ft. (457 m.)	1,050 lb. (476 kg.)	Nil	38.9 in. (988 mm.)	54.9 in. (1,394 mm.)	Vertical Mounting.



The 870 h.p. Alvis Leonides Major two-row radial engine.





Above, the Alvis Leonides 521/1 and, right, the Leonides Major A.Le.M.1-8 helicopter engines.

THE ALVIS LEONIDES MAJOR.

There are two basic versions of the Leonides Major, the A.Le.M.1-7 for fixed-wing aircraft and the A.Le.M.1-8 for helicopter installations. The latter is for vertical mounting, has no airscrew reduction gear-box and has a different disposition of accessories. Otherwise the two engines are similar, the description below applying to both except where specifically indicated.

CYLINDERS.—Bore 4.80 in. (122 mm.). Stroke 4.41 in. (112 mm.). Swept volume 1,117.8 cub. in. (18.34 litres). Compression ratio 6.8 : 1. Nitrided steel barrels, deeply finned, bolted to crankcase. Cast "Y" alloy heads screwed and shrunk on.

PISTONS.—Forged "Y" alloy, with internal finning below crown. Two compression and two scraper rings, one scraper at skirt rest above gudgeon-pin. Fully-floating gudgeon-pins with washers and circlips.

CONNECTING RODS.—I-section master-rods and I-section auxiliary rods machined from high-grade steel. Master-rods have white-metalled steel shell big-end bearings; all other bearings have bronze bushes.

CRANKSHAFT.—Two-throw three-piece shaft machined from high-grade steel. Three roller bearings and one ball-bearing to govern end float.

CRANKCASE.—Three-piece case die-forged in light alloy.

VALVE GEAR.—Two inclined valves per cylinder. Both valves of austenitic steel, exhaust valve sodium-cooled and with Brightray-covered head and seats. Two double-tracked cam discs each track with three cams operating roller followers.

INDUCTION.—Low-pressure fuel injection. Hobson or S.U. fuel pump and fuel injectors.

SUPERCHARGER.—Single-stage single-speed centrifugal blower. Spring drive. Gear ratio 6.5 : 1.

FUEL.—100/130 Grade (DERD 2485).

IGNITION.—Two B.T.H. Type C.14.C/1 magnetos on rear cover. Two Lodge LA/1/1 plugs per cylinder. Plessey fully-screened ignition harness.

LUBRICATION.—Dry sump type. One pressure pump and two scavenge pumps in tandem.

REDUCTION GEAR (A.Le.M.1-7).—Farman type epicyclic gear with fixed bevel and six satellite pinions. Gear ratio 0.533 : 1.

AIRSCREW SHAFT (A.Le.M.1-7) No. 4 size L.H. rotation.

ACCESSORY DRIVE.—Provision for all normal accessories on rear cover, with direct drive.

STARTING (A.Le.M.1-7).—Electric, Rotax C.1254.

STARTING (A.Le.M.1-8).—Cartridge type, Plessey L.41.

MOUNTING.—Dynafocal mountings with four pick-up points.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

CONSUMPTIONS.—

Fuel (at max. continuous power) 57.2 Imp. gal. (260 litres) per hour.

Oil 6-10 pints (3.4-5.7 litres) per hour.

BRISTOL

BRISTOL AERO-ENGINES, LTD.

HEAD OFFICE, WORKS AND AERODROME: FILTON, BRISTOL.

LONDON OFFICE: 6, ARLINGTON STREET, ST. JAMES'S, S.W.1.

Directors: Sir Reginald Verdon Smith, M.A., B.C.L., J.P.; Sir Alec Coryton, K.C.B., K.B.E., M.V.O., D.F.C. (Chairman); Brian Davidson, M.A.; F. R. Banks, C.B., O.B.E., F.R.Ae.S., M.I. Mech.E., F.Inst.Pet.; Dr. S. G. Hooker, O.B.E., D.Phil., D.I.C., F.R.Ae.S. (Chief Engineer); George Hack M.I.Mech.E. (General Manager); John Innes, C.B.E., M.A.; R. L. Ninnes, F.R.Ae.S.; Dr. E. Warlow-Davis, B.A., D.Phil., B.Sc. (Deputy Chief Engineer).

Secretary: J. Pickles, A.M.I.P.E.

Service Manager: H. Stringer, O.B.E.

Because of the progressive growth of the company's aviation activities both at home and abroad, the Bristol Aeroplane Co., Ltd. decided in September, 1955, to transfer the operations of its individual divisions to the control of new subsidiary companies. As part of the re-organisation, a new company known as Bristol Aero-Engines, Ltd. has been formed. It was due to take over the assets and liabilities of the former Aero-Engine Division on January 1, 1956.

The Bristol Aeroplane Co., Ltd. was originally founded in 1910 but it did not enter the aero-engine field until 1920, when an Aero-engine Department was established to design and manufacture radial air-cooled engines.

Its first engine was the famous Jupiter nine-cylinder radial, which was followed in 1927 by the Mercury and in 1932 by the Pegasus. The Mercury, developed for fighter aircraft, was similar to the supercharged Jupiter but was fitted with a reduction gear and had a shorter stroke. It was the first British aero-engine to be approved for controllable-pitch airscrews.

The development of sleeve-valve engines was undertaken by the company in 1926. By 1932 the first engine—the Perseus—a nine-cylinder radial of the same bore and stroke as the Mercury, was running satisfactorily on test. By the end of 1936, the Hercules—a fourteen-cylinder two-row radial sleeve-valve engine—had passed its first civil type test. Experience with these engines prompted the design of the Centaurus, an eighteen-cylinder engine, in many respects similar to the Hercules, but having a longer stroke.

During the last war the Bristol company and its shadow factories produced over 100,000 engines, of which 57,400 were Hercules and 2,500 were Centaurus engines.

The first post-war range of Bristol civil engines were in the Hercules 630 Series. These engines were essentially similar to the military Hercules 100 Series except that they had single-speed superchargers.

These engines were followed by the post-war 200 and 700 Series which had many new features, including copper-based cylinder-heads and a stiffened power section. The most prominent engines in this Series have been the military Mks. 230 and 264 and the civil Mks. 730, 733, 734, 738, 758, 763 and 773.

The Hercules 800 Series have a further stiffening of the power section and, with water/methanol injection, develop 2,150 h.p. for take-off.

The immediate post-war Centaurus engines were the Mks. 18 and 57. The full post-war types were introduced

initially in 1949 and comprised the civil 660 Series and, in 1953, the military Mk. 173. The military Mk. 373 with direct fuel-injection is the latest addition to the Centaurus range.

Hercules 106 engines power the Handley Page Hastings transport now in service in the R.A.F. A new version of this engine, the Mk. 216, will shortly go into service in these aircraft to provide better performance and a longer period between overhauls.

The civil 630 Series engines have been used in the Short Solent, Vickers Viking and Bristol Freighter. These engines have an approved overhaul life of 1,250 hours, and this period is likely to increase.

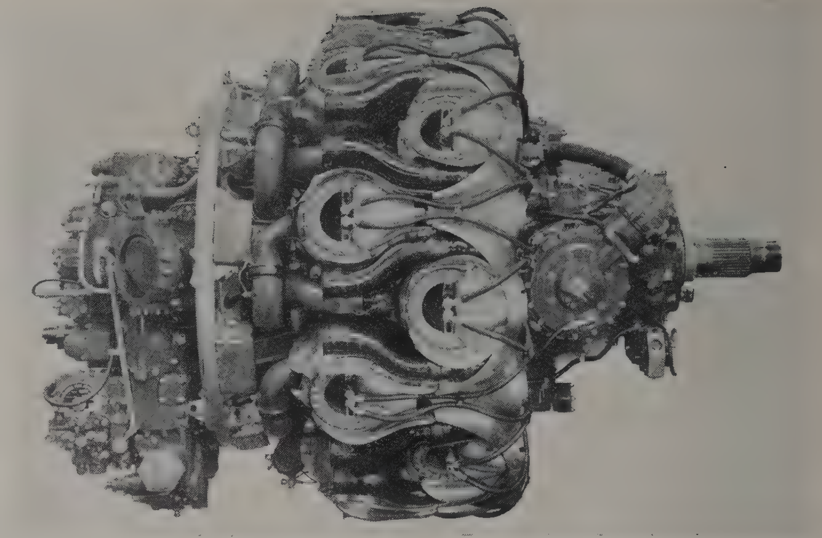
Centaurus 18 engines are still widely used in Hawker Sea Fury. The more recent Centaurus 661 is employed in the Ambassador, or "Elizabethan" class, airliners operated by B.E.A. and is now approved for a life of 1,250 hours between overhauls. A military version, the Centaurus 173, is in production for the Blackburn Beverley heavy freighter for the R.A.F. Its successor, the Centaurus 373, is fitted with a direct fuel-injection system and, with methanol/water injection, develops 3,150 h.p. for take-off.

It is worth noting that all Bristol engines have a name and mark number. Mark numbers below 500 are applied to military engines, while numbers above 500 distinguish civil engines.

Details of Bristol gas-turbine engines will be found in Part I of this Section.

THE BRISTOL CENTAURUS.

The latest marks of Centaurus civil engines are of the 660 series and have two-speed superchargers. They are fitted with copper-based cylinder heads, and embody the necessary drive and face for an airscrew reversing pump, together with a 150 h.p. accessory drive.



The 2,625 h.p. Bristol Centaurus 661 sleeve-valve radial engine.

The Centaurus 18 for the Hawker Sea Fury and the 57 for the Bristol Brigand differ in reduction-gear ratio and type of engine-mounting. In addition the 57 has provision for methanol-water injection giving 2,800 b.h.p. for take-off.

The following are the principal versions of the Centaurus :—

Centaurus 18. Twin-entry two-speed supercharger engine, with 0.44 reduction gear ratio and flexible engine-mounting. Vertically-mounted starter.

Centaurus 57. Twin-entry two-speed supercharger engine, with 0.40 reduction gear ratio and rigid engine-mounting. Vertically-mounted starter and provision for methanol-water injection.

Centaurus 660 Series. Twin-entry two-speed supercharged engines with front ignition system, provision for feathering and reversing airscrew, copper-based cylinder heads and high-power accessory drive (150 h.p.). The engine is mounted on a dynamic-type flexible mounting.

Centaurus 373. Basically similar to the Centaurus 173, but having a direct fuel-injection system instead of the bulk fuel injector. Two nine-cylinder pumps at the rear of the engine supply metered fuel to the injection nozzles, one in each cylinder-head. As with the bulk injector, pump output is controlled by engine

BRISTOL CENTAURUS SLEEVE-VALVE RADIAL ENGINES.

	Bore and Stroke	Capacity	Air-screw Gear Ratio	Diameter	Weight (dry)	Take-off Power	Maximum Power for all-out level flight for 5 mins.	Normal Climb	Maximum Economical Cruising	Fuel Grade
CENTAURUS 18 and 57 (Military)	5¾ in. × 7 in. (146 mm. × 178 mm.)	3,270 cub. in. (53.6 litres)	Mk. 18 0.444 : 1 Mk. 57 .400 : 1	55.3 in. (1.405 m.)	Mk. 18 2,920 lb. (1,324 kg.) Mk. 57 2,830 lb. (1,284 kg.)	2,470 h.p. at 2,700 r.p.m. Mk. 57 2,810 h.p. with methanol water	2,550 h.p. at 2,700 r.p.m. at 4,000 ft. (1,219 m.) and 2,280 h.p. at 2,700 r.p.m. at 16,500 ft. (5,031 m.)	2,160 h.p. at 2,400 r.p.m. at 5,000 ft. (1,524 m.) and 1,975 h.p. at 2,400 r.p.m. at 15,750 ft. (4,800 m.)	1,745 h.p. at 2,400 r.p.m. at 11,000 ft. (3,353 m.) and 1,600 h.p. at 2,400 r.p.m. at 21,250 ft. (6,477 m.)	100/130
CENTAURUS 661 (Civil)	5¾ in. × 7 in. (146 mm. × 178 mm.)	3,270 cub. in. (53.6 litres)	0.400 : 1	55.3 in. (1.405 m.)	3,460 lb. (1,570 kg.)	2,625 h.p. at 2,800 r.p.m.	2,705 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.)	2,265 h.p. at 2,500 r.p.m. at 5,500 ft. (1,680 m.) and 2,110 h.p. at 2,500 r.p.m. at 12,000 ft. (3,660 m.)	1,675 h.p. at 2,400 r.p.m. at 11,500 ft. (3,510 m.) and 1,575 h.p. at 2,400 r.p.m. at 17,500 ft. (5,335 m.)	100/130
CENTAURUS 662 and 663 (Civil)	5¾ in. × 7 in. (146 mm. × 178 mm.)	3,270 cub. in. (53.6 litres)	0.400 : 1	55.3 in. (1.405 m.)	Mk. 662 3,430 lb. (1,555 kg.) Mk. 663 3,465 lb. (1,568 kg.)	2,850 h.p. at 2,800 r.p.m. with methanol water	2,910 h.p. at 2,800 r.p.m. at 2,750 ft. (840 m.) with methanol water	2,265 h.p. at 2,500 r.p.m. at 5,500 ft. (1,840 m.) and 2,110 h.p. at 2,500 r.p.m. at 12,000 ft. (3,660 m.)	1,675 h.p. at 2,400 r.p.m. at 11,500 ft. (3,510 m.) and 1,575 h.p. at 2,400 r.p.m. at 17,500 ft. (5,335 m.)	100/130
CENTAURUS 173 (Military) and 673 (Civil)	5¾ in. × 7 in. (146 mm. × 178 mm.)	3,270 cub. in. (53.6 litres)	0.400 : 1	55.3 in. (1.405 m.)	3,400 lb. (1,540 kg.)	2,850 h.p. at 2,800 r.p.m. with methanol water	2,935 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.) with methanol water	2,390 h.p. at 2,500 r.p.m. at 4,500 ft. (1,371 m.)	1,720 h.p. at 2,400 r.p.m. at 11,500 ft. (3,510 m.)	100/130
CENTAURUS 373 (Military) and 873 (Civil)	5¾ in. × 7 in. (146 mm. × 178 mm.)	3,270 cub. in. (53.6 litres)	0.400 : 1	55.3 in. (1.405 m.)	3,490 lb. (1,583 kg.)	3,150 h.p. at 2,800 r.p.m. with methanol water	3,220 h.p. at 2,800 r.p.m. at 3,000 ft. (915 m.) with methanol water	2,590 h.p. at 2,600 r.p.m. 5,500 ft. at (1,680 m).	1,890 h.p. at 2,500 r.p.m. at 11,500 ft. (3,510 m.)	100/130

r.p.m., supercharger pressure and temperature, and exhaust back pressure.

Centaurus 173. Twin-entry single-speed supercharged engine with dynamic flexible mounting, copper-based head, methanol-water injection, etc.

The description which follows refers to the Type 173.

TYPE.—Eighteen-cylinder two-row air-cooled sleeve-valve radial with single-speed supercharger.

CYLINDER ASSEMBLY.—Bore 5.75 in. (146 mm.). Stroke 7 in. (178 mm.). Swept volume 3,270 cub. in. (53.6 litres). Open ended light alloy barrels with deep closely pitched fins, machined from solid. Cylinder heads of latest fabricated pattern with finned copper base and steel body.

SLEEVE DRIVE.—By simple spur gear trains from front and rear ends of crankshaft, driving short cranks for the front and rear banks respectively. Each sleeve crank is carried at one end in a plain bearing in the crankcase, and at the other end in a plain bearing in the enclosing casing, through which pressure oil is supplied for the sleeve ball assemblies. The cranks run at one half engine speed. Intermediate gears are carried on needle roller-bearings.

PISTONS.—Fully skirted type, with two wedge-section gas rings and a scraper ring above the gudgeon-pin and one bevelled scraper ring in the skirt. Fully-floating gudgeon-pins in pistons and small ends of connecting-rods.

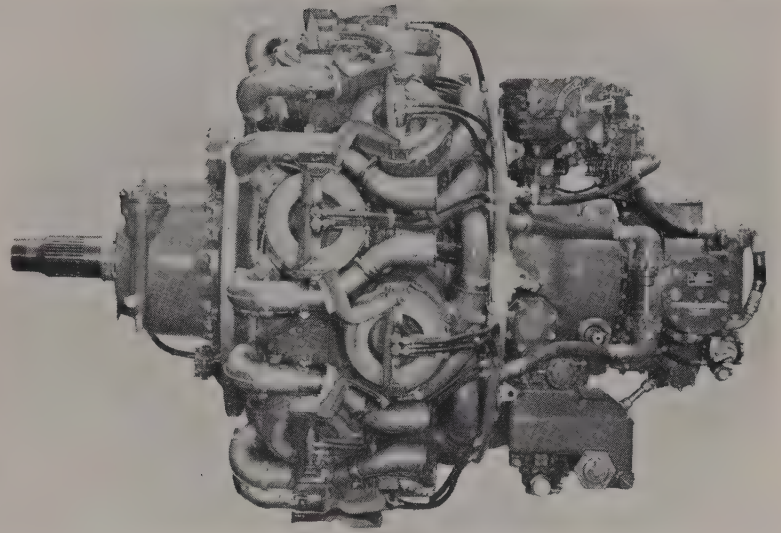
CONNECTING RODS.—Front and rear assemblies each comprising a master-rod, bearing directly on the white metalled crankpin sleeve, and eight articulated rods carried in the master-rod.

CRANKSHAFT.—Three-piece built-up type carried in four roller main bearings. Crankpins formed integral with centre-section, and fitted with white-metalled steel sleeves for big-end bearings.

CRANKCASE.—In three sections, carrying housing for the main bearings and sleeve crank bearings.

FRONT COVER.—Encloses the front bank sleeve-drive mechanism and has a flange and drive for the combined constant-speed unit and airscrew reversing pump, and ignition distributors. There is a small oil pump in the base of the casting to return surplus oil from the front of the engine to the sump.

SUPERCHARGER AND INDUCTION SYSTEM.—Single-speed centrifugal supercharger, housed in a light-alloy casing. The aluminium-alloy impeller is of the double-shrouded type, and has a guide vane rotor mounted with it as an integral unit on the hollow alloy-steel impeller shaft. The drive to the impeller shaft is taken from the rear of the crankshaft through spur gear trains. A vaned diffuser ring encircling the impeller passes the compressed mixture to the annular diffuser chamber formed in the supercharger casing, whence eighteen aluminium-alloy induction pipes lead to the cylinders. The supercharger casing incorporates drives and faces for engine accessories, including the ignition generators, the fuel-pump and the electric starter. The engine rear cover is replaced by a simple plate which encloses the rear of the supercharger, and provides a bearing for the 150 h.p. accessory drive.



The 2,080 h.p. Bristol Hercules 763 sleeve-valve radial engine.

FUEL SYSTEM.—A Hobson-R.A.E. injector is fitted, supplying two spray nozzles, one in each intake trunk. The fuel pump is an integral part of the injector and is driven from a gear train in the supercharger casing.

IGNITION SYSTEM.—Twin L.T. generators mounted at the rear of the engine supply twin H.T. transformers and distributors on the front cover. Two plugs in each cylinder are separately supplied by each distributor through leads enclosed in a waterproof screened harness.

LUBRICATION SYSTEM.—Direct pressure lubrication from oil pump in the sump through hollow main driving shaft and crankshaft to supply pressure oil to the supercharger, big end bearings and reduction gear. Separate pressure lines delivering oil to the sleeve driving mechanism. Pistons and sleeve splash-lubricated and supplemented by oil jets in the crankshaft. Oil in sump returned to tank by scavenge pump which is integral with pressure pump.

REDUCTION GEAR.—Epicyclic bevel type with a ratio of 0.40 : 1. The gears are located by spherical seats, spreading the load evenly over the three bevel pinions. Rear bevel wheel is driven from the crankshaft through a toothed coupling. All engines bearing an odd type number (*e.g.* Centaurus 173 etc). have a torquemeter built integral with the reduction gear.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE BRISTOL HERCULES.

The Hercules is by far the most widely used of the Bristol sleeve-valve engines. There are many types, which divide into the following groups :—

Hercules Series. 100 Military series. Two-speed supercharger, two-piece aluminium-alloy cylinder head.

Hercules 630 and 670 Series. Single-speed supercharged civil versions of the Hercules 100.

Hercules 230 Series. Single-speed supercharger, copper-based cylinder heads and stiffened power section, for military applications.

Hercules 730 Series. Civil version of Hercules 230 Series.

Hercules 750 Series. Similar to Hercules 730 Series, but with provision for reversing propellers and 30 h.p. accessory drive. The Hercules 758 is being built under licence in France by S.N.E.C.M.A.

Hercules 760 Series. Two-speed supercharged civil engine, with copper-based cylinder heads, provision for reversing propellers and 150 h.p. accessory drive. Rated on 115/145 grade fuel.

Hercules 770 Series. Similar to Hercules 760, but rated on 100/130 Grade fuel, and with methanol/water injection for take-off. Supercharger locked in low gear.

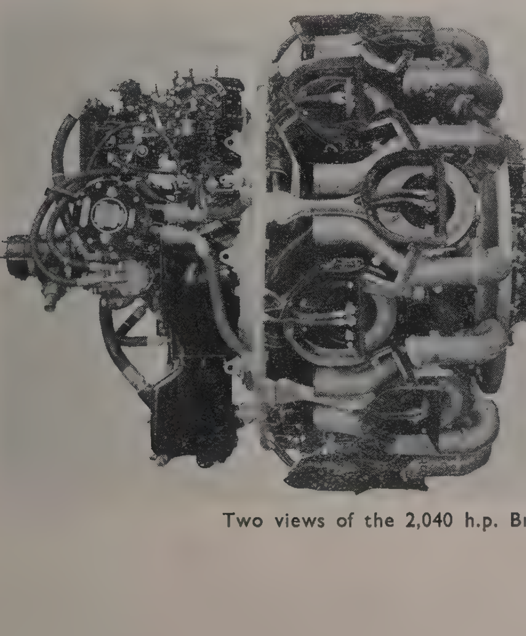
Hercules 260 Series. Military version of Hercules 760 Series.

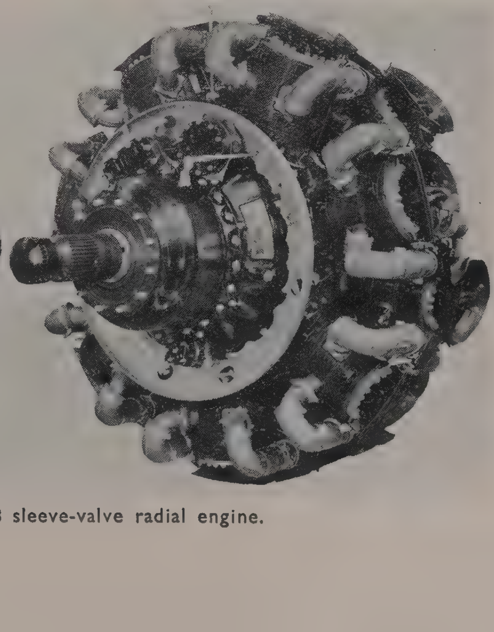
Hercules 811 Series. Similar to 750 Series but stiffened for higher rating and using water/methanol injection.

The description which follows refers to the Hercules 811.

TYPE.—Fourteen-cylinder two-row air-cooled sleeve-valve radial with single-speed supercharger.

CYLINDER ASSEMBLY.—Bore 5¾in. (146 mm.). Stroke 6½ in. (165 mm.). Swept volume 2,360 cub. in. (38.7 litres). Open-ended light alloy barrels with deep closely-pitched





Two views of the 2,040 h.p. Bristol Hercules 758 sleeve-valve radial engine.

BRISTOL HERCULES SLEEVE-VALVE RADIAL ENGINES.

	Bore and Stroke	Capacity	Air-screw Gear Ratio	Diameter	Weight (dry)	Take-off Power	Maximum Power for all-out level flight for 5 mins.	Normal Climb	Maximum Economical Cruising	Fuel Grade
Hercules 106 Military)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,090 lb. (948 kg.)	1,675 h.p. at 2,800 r.p.m.	1,775 h.p. at 2,800 r.p.m. at 7,250 ft. (2,210 m.) and 1,595 h.p. at 2,800 r.p.m. at 17,500 ft. (5,336 m.)	1,360 h.p. at 2,400 r.p.m. at 8,000 ft. (2,438 m.) and 1,280 h.p. at 2,400 r.p.m. at 16,500 ft. (5,031 m.)	1,115 h.p. at 2,400 r.p.m. at 13,250 ft. (4,040 m.) and 1,050 h.p. at 2,400 r.p.m. at 21,500 ft. (6,557 m.)	100/130
Hercules 634 and 638 (Civil)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.	Mk. 634 1,945 lb. (882 kg.) Mk. 638 1,955 lb. (886 kg.	1,690 h.p. at 2,800 r.p.m.	1,780 h.p. at 2,800 r.p.m. at 6,500 ft. (1,981 m.)	1,510 h.p. at 2,400 r.p.m. at 3,750 ft. (1,143 m.)	1,315 h.p. at 2,400 r.p.m. at 8,250 ft. (2,514 m.)	100/130
Hercules 637 and 672 (Civil)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mk. 637 1,980 lb. (898 kg.) Mk. 672 1,960 lb. (889 kg.)	1,690 h.p. at 2,800 r.p.m.	1,780 h.p. at 2,800 r.p.m. at 6,500 ft. (1,981 m.)	1,590 h.p. at 2,500 r.p.m. at 5,250 ft. (1,600 m.)	1.320 h.p. at 2,400 r.p.m. at 8,500 ft. (2,590 m.)	100/130
Hercules 230 and 270 (Military)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mk. 230 2,115 lb. (960 kg.) Mk. 270 2,135 lb. (959 kg.)	1,925 h.p. at 2,800 r.p.m.	2,000 h.p. at 2,800 r.p.m. at 5,000 ft. (1,524 m.)	1,650 h.p. at 2,400 r.p.m. at 3,250 ft. (990 m.)	1,270 h.p. at 2,400 r.p.m. at 10,250 ft. (3,124 m.)	100/130
Hercules 234 (Military) and 734 (Civil)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 in.)	Mks. 234, 734 2,150 lb. (960 kg.) Mks. 235, 735 2,150 lb. (975 kg.)	1,980 h.p. at 2,800 r.p.m.	2,020 h.p. at 2,800 r.p.m. at 2,750 ft. (838 m.)	1,660 h.p. at 2,500 r.p.m. at 4.500 ft. (1,372 m.)	1,220 h.p. at 2,400 r.p.m. at 10,500 ft. (3,200 m.)	100/130
Hercules 733, 737, 738, 758, 759 (Civil)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mks. 733, 737, 2,150 lb. (975 kg.) Mk. 738 2,115 lb. (960 kg.) Mk. 758 2,175 lb. (986 kg.) Mk. 759 2,200 lb. (998 kg.)	2,040 h.p. at 2,800 r.p.m.	2,090 h.p. at 2,800 r.p.m. at 3,000 ft. (914 m.)	1,670 h.p. at 2,500 r.p.m. at 5,000 ft. (1,524 m.)	1,215 h.p. at 2,400 r.p.m. at 10,750 ft. (3,276 m.)	100/130
Hercules 763 (Civil)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,395 lb. (1,086 kg.)	2,080 h.p. at 2.900 r.p.m.	2,140 h.p. at 2,900 r.p.m. at 3,750 ft. (1,143 m.)	1,655 h.p. at 2,500 r.p.m. at 5,750 ft. (1,753 m.) and 1,535 h.p. at 2,500 r.p.m. at 16,500 ft. (5,031 m.)	1,220 h.p. at 2,400 r.p.m. at 12,500 ft. (3,810 m.) and 1,135 h.p. at 2,400 r.p.m. at 22,250 ft. (6,782 m.)	115/145
Hercules 773 (Civil)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,395 lb. (1,086 kg.)	2,125 h.p. at 2,900 r.p.m. with methanol water	2,150 h.p. at 2,900 r.p.m. at 1,500 ft. (457 m.) with methanol water	1,635 h.p. at 2,500 r.p.m. at 2,750 ft. (838 m.)	1,160 h.p. at 2,400 r.p.m. at 9,750 ft. (2,970 m.)	100/130
Hercules 264 (Military)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,305 lb. (1,045 kg.)	1,950 h.p. at 2,800 r.p.m.	1,990 h.p. at 2,800 r.p.m. at 2,750 ft. (838 m.)	1,605 h.p. at 2,400 r.p.m. at 2,750 ft. (837 m.) and 1,535 h.p. at 2,400 r.p.m. at 11,000 ft. (3,353 m.)	1,125 h.p. at 2,400 r.p.m. at 11,750 ft. (3,572 m.) and 1,065 h.p. at 2,400 r.p.m. at 19,500 ft. (5,950 m.)	100/130
Hercules 216 (Military)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,205 lb. (1,000 kg.)	1,800 h.p. at 2,800 r.p.m.	1,915 h.p. at 2,800 r.p.m. at 8,250 ft. (2,514 m.)	1,545 h.p. at 2,500 r.p.m. at 9,750 ft. (2,970 m.)	1,155 h.p. at 2,400 r.p.m. at 15,500 ft. (4,720 m.)	100/130
Hercules 811 (Civil)	$5\frac{3}{4}$ in. × $6\frac{1}{2}$ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,235 lb. (1,013 kg.)	2,200 h.p. at 2,900 r.p.m. with water methanol	2,250 h.p. at 2,900 r.p.m. at 3,000 ft. (915 m.) with water methanol	1,735 h.p. at 2,600 r.p.m. at 6.000 ft. (1,830 m.)	1,250 h.p. at 2,400 r.p.m. at 10,000 ft. (3,050 m.)	100/130

fins, machined from solid. Cylinder heads have finned copper bases and steel bodies.

Sleeve Drive.—By simple spur gear trains from the front end of the crankshaft, driving short cranks for the sleeves of the front bank and long cranks for the rear bank. Each sleeve crank is carried at one end in a self-aligning bearing in the crankcase, and at the other end in a plain bearing in the front cover, through which pressure oil is supplied for the sleeve ball assemblies. The cranks run at one half engine speed and the intermediate gears are carried on needle roller-bearings.

Pistons.—Fully-skirted type, with two wedge-section gas rings and a scraper ring above the gudgeon-pin and one bevelled scraper ring in the skirt. Gudgeon-pins fully-floating in pistons and small ends of connecting-rods.

Connecting Rods.—Front and rear assemblies each comprising a master-rod, bearing directly on the white-metalled crankpin sleeve and six articulated rods carried in the master rod.

Crankshaft.—Three-piece built-up type carried in four roller main bearings. Crankpins formed integral with centre section and fitted with white-metalled steel sleeves for big-end bearings.

Crankcase.—In three sections, carrying housings for the main bearings and sleeve crank bearings.

Front Cover.—Encloses the sleeve drive mechanism and has flanges and drives for the constant-speed unit and airscrew reversing pump. There is a small oil pump in the base of the casting to return surplus oil from the front of the engine to the sump.

Supercharger.—Single-speed supercharger with duplicate driving trains. Single down-draught intake and double-shrouded aluminium-alloy impeller. Individual induction pipes with screwed joints to all cylinders.

Rear Cover.—Carries the essential engine accessories, magnetos, starter and fuel pump, and embodies a high-powered accessory drive (150 h.p. max.) for cabin superchargers, etc.

Fuel System.—A Hobson-R.A.E. injector is fitted as standard.

Ignition System.—Two magnetos supply separately two plugs per cylinder. Waterproof and fully-screened ignition harness.

Lubrication System.—Direct pressure lubrication from oil pump in the sump through hollow main driving shaft and crankshaft, to supercharger, big end bearings and reduction gear. Separate pressure lines deliver oil to sleeve driving mechanism. Pistons and sleeves splash lubricated and supplemented by oil jets in the crankshaft. Oil in sump returned to tank by scavenge pump which is integral with pressure pump.

Reduction Gear.—Epicyclic bevel type with a ratio of 0.44 : 1. The front and rear bevels are located by spherical seats, spreading the load evenly over the three bevel pinions. Rear bevel wheel is driven from the crankshaft through a toothed coupling. Large diameter internal oil passages and oil transfer system ensure rapid propeller reversing. Torquemeter built integral with the reduction gear.

Dimensions, Weight and Performance.—See Table.

CIRRUS

ENGINE DIVISION, BLACKBURN AND GENERAL AIRCRAFT LTD.

Head Office and Works: Engine Dept., Brough, E. Yorks.

London Office: 43, Berkeley Square, London W.1.

Directors: E. Turner, A.C.A. (Managing Director), Major F. A. Bumpus, B.Sc., A.R.C.S., Wh.Sc., F.R.Ae.S., N. E. Rowe, C.B.E., B.Sc., M.I.Mech.E., Whit.Ex., F.R.Ae.S., Sir Maurice Bonham Carter, K.C.B. K.C.V.O., W. A. Hargreaves, M.B.E., A.M.I.C.E., F.R.Ae.S. and Air Vice-Marshal H. N. Thornton, C.B.E.

Chief Designer: F. R. Bell.

Sales Manager: Group-Capt. H. J. Wilson, C.B.E., A.F.C.

The Cirrus aero-engine, the pioneer light four-cylinder in-line air-cooled engine, made possible the light aeroplane of to-day, and its long list of successes in light aircraft of many types dates back to 1925. It is true to say that the light aeroplane movement was founded on the Cirrus engine which is now so widely known throughout the World that it needs no further introduction.

During post-war years the Cirrus Engine Division has been developing direct petrol injection engines and the first of these to be completed and to pass the British Air Registration Board approval tests is the Bombardier, which is described below.

The British manufacturing rights for Turbomeca gas-turbine engines were acquired in October, 1952. Details of these units will be found under "Blackburn-Turbomeca" in Part I of this Section.

THE CIRRUS BOMBARDIER 702.

The Bombardier is intended primarily for use with the Fairey Reed thin-boss fixed-pitch metal airscrew. If required an optional airscrew hub is available for use with a conventional thick-boss fixed-pitch airscrew, either metal or wood. The engine can also be adapted for the use of a constant-speed airscrew.

The engine is fitted with fuel-injection equipment and will be suitable for use with safety fuels when these become available.

Type.—Four-cylinder in-line inverted air-cooled. Direct drive L.H. tractor.

Cylinders.—Bore 4.8 in. (121.92 mm.). Stroke 5.5 in. (139.7 mm.). Capacity 398.12 cub. in. (6.524 litres). Compression ratio 7 : 1. High carbon steel barrels machined from solid, with Y-alloy pent-roof type head screwed on. Cylinders attached to crankcase by eight studs and nuts. Each cylinder head has fitted two sparking plug adapters, inlet and exhaust valve seat inserts and an adapter for a fuel injection nozzle.

Pistons.—Aluminium alloy slipper type. Two compression and one scraper ring. Fully floating gudgeon pins located by end washers and circlips.

Connecting Rods.—H-section aluminium-alloy forgings with copper-lead steel-backed big-end bearings.

Crankshaft.—Fully machined high tensile steel forging balanced statically and dynamically running in five copper-lead steel-backed main journal bearings. Thrust bearing combined with front main journal bearing. Two integral collars on front end of shaft to take thrust.

Crankcase Assembly.—Magnesium alloy castings, comprising front cover, crankcase, top cover and rear cover. Crankcase houses lower halves of main journal bearings and thrust bearing. Top cover houses upper halves of bearings and also carries the front lifting eye integral with top cover. Rear cover houses rear gear train and has mounting faces for fitting auxiliaries and accessories, rear lifting eye integral with rear cover.

Valve Gear.—One inlet and one exhaust valve per cylinder. Camshaft carried in carrier plate and driven by vertical shaft through bevel gears. Valve operating gear enclosed in cover which acts as oil bath for valve gear and sump from which oil is scavenged.

Ignition.—B.T.H. Duplex magneto. Fully-screened ignition harness.

Fuel System.—Two Amal type 240/48 engine-driven fuel pumps supply fuel to S.U. injection pump driven from rear gear train. S.U. pump meters fuel through rigid injection pipes to fuel injection nozzles. Injection metering varied quantitatively with manifold pressure, air intake temperature and altitude by variation of pump stroke controlled by capsule and oil servo mechanism.

Fuel.—Gasoline, 91/98 Octane minimum.

Lubrication.—One pressure pump and duplex scavenge pump.

Accessories (Optional).—Plessey Type B3X Mk. 3 vacuum pump. Rotax type B1815 electric generator. Hymatic air compressor. Electric tachometer generator (unless C.S.U. is fitted). Constant speed unit. Mechanical tachometer.

Airscrew.—Standard, Fairey Reed Type 66960 thin-boss fixed-pitch metal airscrew. Optional, approved thick-boss fixed-pitch airscrews and approved constant-speed and variable-pitch airscrews.

Starting.—Rotax 24-volt electric (direct-cranking).

Cooling.—Air scoop and cylinder baffles supplied with engine.

Dimensions.—
- Length overall 45.3 in. (1,152 mm.).
- Height 30.95 in. (786 mm.).
- Width 19 in. (483 mm.).

Net Dry Weight.—
- Including fuel pumps, screened ignition and airscrew hub but excluding bearer feet and exhaust system 379 lb. (172 kg.) + $2\frac{1}{2}$%.

Performance.—
- Take-off 180 h.p. at 2,600 r.p.m. at sea level.
- Max. continuous power rating 158 h.p. at 2,300 r.p.m. at 1,250 ft. (380 m.).
- Max. weak mixture power 140 h.p. at 2,200 r.p.m. at 3,250 ft. (990 m.).

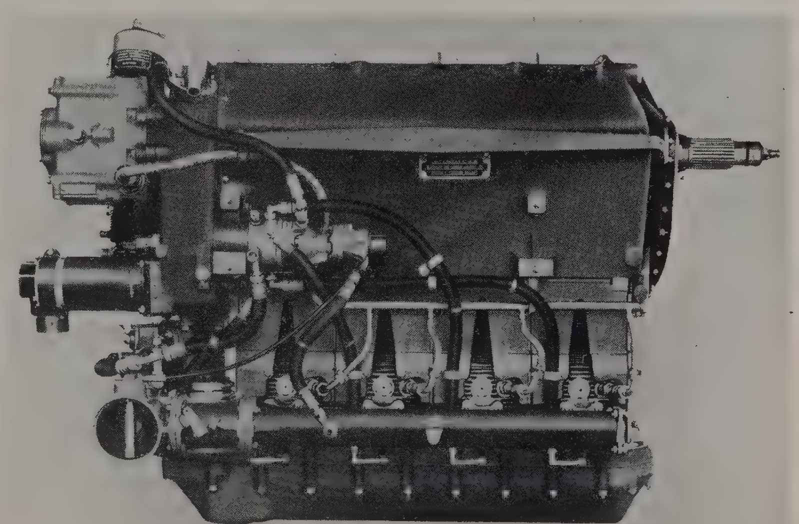
Fuel Consumptions.—
- Max. take-off (upper limit) 13.75 Imp. gallons (62.42 litres) per hour.
- Max. continuous (upper limit) 10.75 Imp. gallons (48.80 litres) per hour.

Oil Consumption.—
- At max. continuous rating 1.0 to 3.5 pints (0.57 to 1.98 litres) per hour.

THE CIRRUS MAJOR SERIES 3.

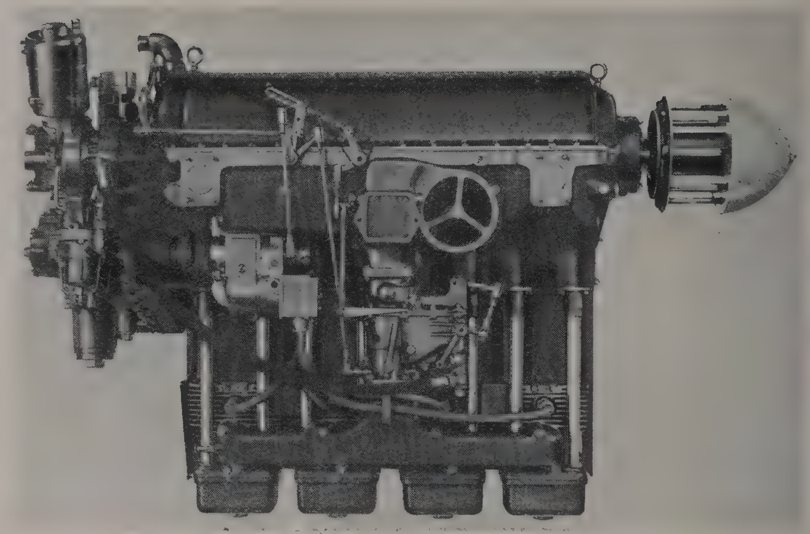
Type.—Four-cylinder in-line air-cooled inverted.

Cylinders.—Bore 4.724 in. (120 mm.). Stroke 5.512 in. (140 mm.). Capacity 386.4 cub. in. (6.3 litres). Compression ratio 6.5 : 1. Barrels are machined from high-grade steel ingots and are located in crankcase by large spigot and four short studs securing cylinder base flange. Cylinder-heads are of aluminium-alloy with one inlet and one exhaust valve. Heads attached to barrels by twelve securing studs.



The 180 h.p. Cirrus Bombardier 702 engine.

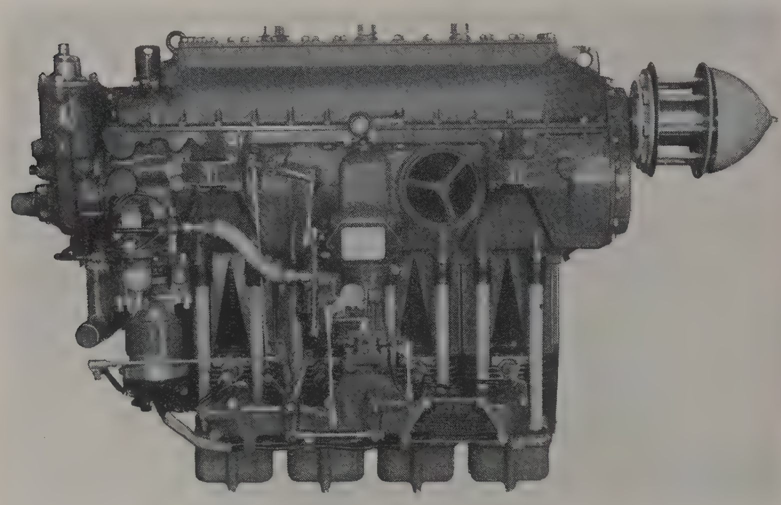
VALVE GEAR.—Operation, etc., as in Minor Series 2A.
PISTONS.—Slipper type of Y-alloy, with two tapered compression and one scraper ring.
CONNECTING RODS.—Hiduminium forgings fitted with steel-backed white-metal bearings.
CRANKSHAFT.—Steel forging, machined all over carried in five plain bearings. Ball thrust-bearing at front end.
CRANKCASE.—Aluminium-alloy casting with Electron top-cover. The timing-gear cover at rear carries the auxiliaries and does not disturb any gears when removed as they are housed in the crankcase.
CARBURATION.—One Claudel-Hobson down-draught carburetter with flame-trap and direct cold air intake, and having an independent mixture control, on one-piece cast induction manifold. The cold air intake operates automatically at approximately 90% to full-throttle opening. Provision for fire-fighting attachments on induction manifold.
FUEL.—Gasoline, 80 Octane minimum. Fuels containing tetra-ethyl-lead can be used.
IGNITION.—Two B.T.H. magnetos, one with impulse starter. Lodge or K.L.G. sparking plugs of approved types. Plessey screened harness if desired.
LUBRICATION.—Pressure feed system with scavenge pump. All oilways internal in crankcase casting. Pressure and scavenge filters embodied in the oil-pump.
AIRSCREW DRIVE.—Direct, left-hand tractor.
ACCESSORIES.—Rotax (electric) or Coffman (cartridge) starter, Rotax or Pesco vacuum-pump, Rotax generator, Hymatic Compressor.
DIMENSIONS.—
Overall length less spinner 40.7 in. (1,034 mm.).
Overall height 30.8 in. (792.5 mm.).
Overall width 15.2 in. (386 mm.).
WEIGHT.—
Including airscrew hub but excluding fuel pumps, bearer feet and exhaust stubs 345 lb. (156.6 kg.) + 2½%.
PERFORMANCE.—
Take-off output 146 h.p. at 2,200 r.p.m. at sea level.
Max. cruising output 138 h.p. at 2,200 r.p.m. at 1,500 ft. (460 m.).
Max output 158 h.p. at 2,450 r.p.m. at sea level.
FUEL CONSUMPTIONS.—
Take-off 11 gallons (50 litres) per hour.
Max. cruise 10 gallons (45.4 litres) per hour.
OIL CONSUMPTION.—
Max. cruise 0.75 to 2.0 pints (0.43 to 1.13 litres) per hour.



The 146 h.p. Cirrus Major Series 3 engine.

THE CIRRUS MINOR SERIES 2A.

TYPE.—Four-cylinder in-line inverted air-cooled.
CYLINDERS.—Bore 3.9 in. (100 mm.). Stroke 5 in. (127 mm.). Capacity 243.5 cub. in. (3.99 litres). Compression ratio 6.25 : 1. Carbon steel cylinders with machined fins. Pent-roof type Y-alloy detachable head attached to cylinder by eight studs and nuts. A gas-tight joint is ensured by a spigot on the cylinder and a copper joint-washer. Cylinders are attached to crank-case by short studs.
PISTONS.—Slipper type of Y-alloy. Fully-floating gudgeon-pins. One scraper and two compression rings.
VALVE GEAR.—One inlet and one exhaust valve per cylinder, operated from camshaft through cup-ended tappets, rocker arms and ball-ended push-rods. Clearance adjusted by screwed cup in one end of rocker. Valves stellited. Camshaft in crankcase has a phospor bronze thrust-bearing at the front end from which end the camshaft is driven through spur gears. Timing gears at front of engine.
CONNECTING RODS.—Hiduminium forgings with steel-backed white metal bearings.
CRANKSHAFT.—Steel forging carried in five plain white metal bearings. Ball thrust bearing at the front end and gear wheel at rear end for driving the two vertical magneto drive-shafts, which also operate the fuel pumps.
CRANKCASE ASSEMBLY.—Magnesium alloy. Top cover with separate main bearing caps located by studs from crankcase through bearing cap and cover plate. Studs fitted in top cover secure top plate and ensure an oil tight joint. Lifting eyes fore and aft. Cast breather fitted at rear end.
IGNITION.—Two B.T.H. SG4 magnetos (one with impulse starter) driven from crank-shaft through spiral gears. Integrally screened sparking-plugs, Plessey-Breeze screening harness optional.
CARBURATION.—Zenith downdraught carburettor with independent mixture control, also hot and cold air intake, on one-piece cast induction-manifold. Warm air from the cowling is admitted through the flame-trap up to approximately 90% of the throttle opening, after which a direct cold air intake comes into operation. Provision for fire-fighting attachments on induction manifold. Dual fuel-pumps operated by cams on magneto driving shafts.
FUEL.—Gasoline, 73 Octane minimum. Fuels containing tetra-ethyl-lead can be used.
LUBRICATION.—Gear-type oil-pump, incorporating Auto-clean filter. Pressure-feed system to main and big-end bearings. Gravity drain system. An extension of the oil-pump spindle provides a power take-off point.
ACCESSORIES.—Amal fuel pump; Hymatic compressor; Rotax starter; Rotax generator; vacuum pump.
AIRSCREW DRIVE.—Direct left-hand tractor.
DIMENSIONS.—
Overall length less spinner less starter 37.6 in. (955 mm.).
Height 26.02 in. (661 mm.).
Width 15.2 in. (386 mm.).
WEIGHT.—
Including propeller hub but excluding fuel pumps, bearer feet and exhaust system 247 lb. (112 kg.) + 2½%.
PERFORMANCE.—
Take-off output 92 h.p. at 2,300 r.p.m. at sea level.
Max. cruising 82 h.p. at 2,300 r.p.m. at 3,000 ft. (915 m.).
Max. weak mixture 78 h.p. at 2,200 r.p.m. at 3,000 ft. (915 m.).
Max. output 100 h.p. at 2,600 r.p.m.
FUEL CONSUMPTIONS.—
Max. cruising 6.0 Imp. gallons (27.27 litres) per hour.
Max. weak mixture 5.5 Imp. gallons (25 litres) per hour.
OIL CONSUMPTION.—
1 to 2 pints (0.57 to 1.13 litres) per hour.



The 92 h.p. Cirrus Minor Series 2A engine.

DE HAVILLAND

THE DE HAVILLAND ENGINE CO., LTD.

HEAD OFFICE: LEAVESDEN, HERTFORDSHIRE.

Directors: A. F. Burke, O.B.E., M.Inst.T., F.R.S.A. (Chairman and Managing Director), F. T. Hearle, C.B.E., M.I.P.E., F.R.Ae.S., Sir Geoffrey de Havilland, C.B.E., A.F.C., F.R.Ae.S., R.D.I., W. E. Nixon, F.C.I.S., F. E. N. St. Barbe, J. L. P. Brodie, M.I.A.E., M.I.Mech.E., Dr. E. S. Moult, Ph.D., B.Sc. (Eng.), M.I.Mech.E., F.R.Ae.S. and H. Buckingham.

The de Havilland Engine Co. Ltd. was formed in February, 1944, from the Engine Division of the de Havilland Aircraft Co., Ltd. In addition to its range of gas-turbine engines, the company continues to manufacture the well-known Gipsy four and six-cylinder air-cooled piston engines.

The current range of Gipsy engines includes the 250 h.p. direct-drive normally-aspirated Gipsy Queen Series 30; the 340 h.p. and 380 h.p. (Mk. 2) geared and supercharged Gipsy Queen Series 70, both six-cylinder engines; and the 145 h.p. Gipsy Major 10 four-cylinder engine.

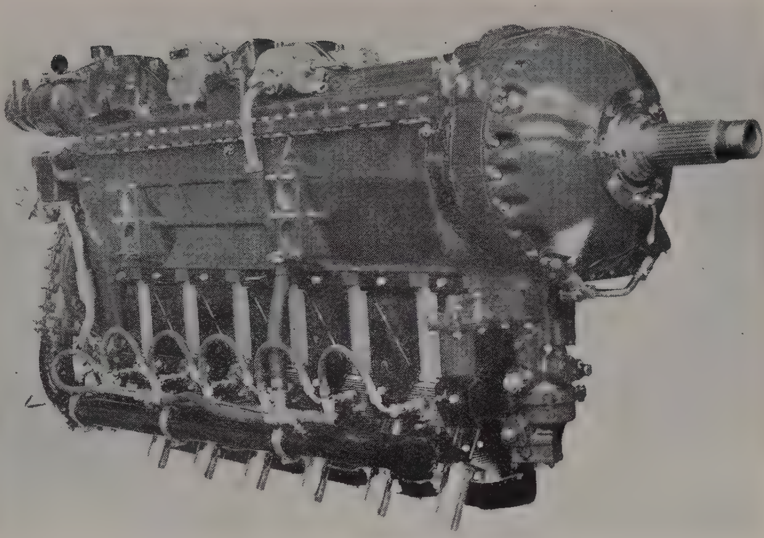
The Gipsy Queen Series 70 is the power

unit of the D.H. Dove twin-engined light transport and is also fitted to the Short Sealand amphibian and the Handley Page Marathon. The Gipsy Queen 30 Mark 2 is the power-plant of the de Havilland Heron four-engined feeder liner.

The Gipsy Major 10 is an improved and refined post-war version of the Gipsy Major I. It can be fitted with an electric starter, generator and vacuum pump if required and is adaptable for either a fixed-pitch or, in the case of the Mk. 2 engine, the D.H. manually-operated controllable-pitch propeller. The current forms of this engine are the Series 10 Mark 2 and the Series 8.

The Gipsy Major 200 is the latest engine in the four-cylinder series. It makes use of the Gipsy Queen 30/70 Series cylinder heads and barrels, has S.U. fuel injection and an entirely new crankcase and accessory layout. It is suitable for both fixed or rotary wing application.

Details of de Havilland gas-turbine engines will be found in Part I of this Section.



The 380 h.p. de Havilland Gipsy Queen Series 70 Mk. 2 engine.

THE D.H. GIPSY QUEEN SERIES.

TYPE.—Six-cylinder in-line inverted air-cooled direct-drive (Series 30) or geared and supercharged (Series 70).

CYLINDERS.—Bore 4.725 in. (120 mm.). Stroke 5.905 in. (150 mm.). Swept volume 622 cub. in. (10.178 litres). Compression ratio 6.5 : 1. Barrels machined all over from carbon steel forgings. Working portion of bore hard-chromed. Barrel spigots into crankcase and aluminium-alloy head clamped to barrel and crankcase by four long steel studs. Moulded Dermatine or Neoprene ring between cylinder and crankcase and plain copper washer between barrel and head.

PISTONS.—Fully-skirted, machined from light alloy forgings with two compression and one scraper rings. Fully floating gudgeon-pin located by external circlips and washers.

CONNECTING RODS (Series 30).—I-section aluminium-alloy forgings. Split big-ends have thin-wall linings. Small-end bearings unbushed and drilled for lubrication.

CONNECTING RODS (Series 70).—I-section nickel-chrome steel forgings. Split big-ends with thin-wall linings. Small-ends have phosphor-bronze bushes.

CRANKSHAFT.—Six-throw shaft is a nickel-chrome forging machined all over and statically and dynamically balanced. Shaft runs on eight plain main bearings in case of Queen 30 and seven in case of Queen 70. Bearings of normal split type lined with thin-wall shells which consist of a steel strip backing lined with lead-bronze on which thin skin of lead is deposited. A fine wall of indium is infused into bearing surface. In case of Series 70 an epicyclic reduction gear is driven off crankshaft through non-lined spring coupling. Gear ratio 0.711 : 1. Propeller shaft is supported at the rear by two plain white-metalled bearings and at the front by single-row ball-bearing transmitting thrust in either direction through reduction-gear casing.

CRANKCASE (Series 70).—Aluminium-alloy main case stiffened by cross webs which carry the main and camshaft bearings, and additionally strengthened by two cross bolts, passing through the upper part of web and bearing cap of Nos. 1 and 4 main bearings. Rear wall extends below level of cylinder mounting face to form sump. Top cover is magnesium-alloy casting and carries magnetos, distributors, vacuum pump, air compressor (hydraulic pump alternative) and their drives.

CRANKCASE (Series 30).—Basically similar to that of Queen 70, main differences being that it is in magnesium-alloy, that a cross shaft bolt is only fitted at No. 4 main bearing and that rear of crankcase is closed by rear cover.

VALVE GEAR.—Fully enclosed, one inlet and one exhaust valve to each cylinder. Operation by steel rockers, tubular aluminium-alloy push-rods and steel tappets of hollow steel camshaft running in plain bearings in port side of crankcase. Camshaft driven by spur gears from front end of crankshaft. Both inlet and exhaust valve stems tipped with Stellite and head of exhaust valve and that portion of stem exposed to exhaust gases surfaces with Brightray. Solium-cooled exhaust valves.

INDUCTION (Series 30).—Pair of single-choke Hobson type A.I.55E/1 downdraught carburettors, each feeding three cylinders through separate three-branch manifolds. Air intake incorporates hot and cold air intake shutter and flame-trap.

INDUCTION (Series 70).—Hobson type DHG/1 fuel-injection unit metering fuel through injection nozzle into eye of supercharger impeller.

SUPERCHARGER (Series 70). Centrifugal type driven through two gear trains and a spring quillshaft which is co-axial with end passes through hollow camshaft. Gear Ratio 11.22 : 1.

IGNITION.—Two screened B.T.H. type CGD magnetos and B.T.H. distributors mounted on crankcase top cover and gear-driven from an auxiliary drive shaft at 1½ and ½ times engine speed respectively. Two sparking plugs per cylinder. Fixed ignition.

LUBRICATION.—Dry sump system, one pressure and two scavenge pumps with fabric-type pressure filter. Gauze filters on suction side for all three pumps. Main bearings, big end and most bearings fed with oil under pressure. Pistons and cylinder walls sprayed with oil by jets from big ends supplemented by oil mist; other moving parts by oil mist or splash. Valves and rocker gear operate in oil baths. Provision for Worth oil dilution system.

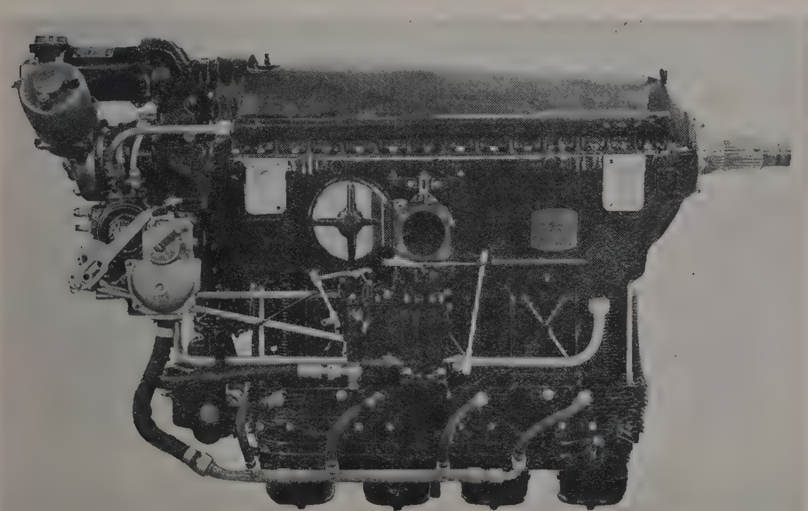
ACCESSORIES.—All accessories driven off rear of auxiliary drive shaft, each accessory coupled to its driving gear by splined coupling sleeve. Electric starter complete with hand turning gear or feathering pump is provided. Accessories include vacuum pump, generator up to 1,500 watts and provision can be made for compressor or hydraulic pump.

COOLING.—Scoops are fitted to the port side of the engine. Air collected by these scoops is passed between the cylinders and heads and suitably deflected by special baffles on starboard side of engine.

AIRSCREW (Queen 70).—Either (*a*) de Havilland bracket constant-speed type airscrew, or (*b*) de Havilland hydromatic constant-speed feathering and braking airscrew, or other approved constant-speed airscrew.

AIRSCREW (Queen 30).—(*a*) or (*b*) as above. In addition (*c*) any approved type of fixed-pitch airscrew, either metal or wood.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.



The 145 h.p. de Havilland Gipsy Major 10 Mk. 2 engine.

THE DE HAVILLAND GIPSY MAJOR 10 Mk. 2.

TYPE.—Four-cylinder in-line inverted air-cooled, direct-drive.

CYLINDERS.—Bore 4.646 in. (118 mm.). Stroke 5.512 in. (140 mm.). Swept volume 373.6 cub. in. (6.124 litres). Compression ratio 6 : 1. Barrels machined all over from forgings of carbon steel. Detachable heads of aluminium-alloy held by long H.T. steel studs to crankcase. Copper-asbestos gasket between cylinder barrel and head to ensure gastight joint.

PISTONS.—Slipper type machined from aluminium-alloy forgings. Fully-floating gudgeon-pin located by external circlips and washers. One scraper and two compression rings below gudgeon pin.

CONNECTING RODS.—Machined all over from light-alloy stampings with split big-ends clamped together by four bolts and nuts. Big-end bearing of steel-backed white metal-lined type. Small end bearings unbushed.

CRANKSHAFT.—Machined all over from nickel-chromium-alloy steel forgings. Statically and dynamically balanced. Five steel-backed thin-wall Vandervell type main bearings. Ball-bearing to take thrust at front end. Journals and pins bored for lightness and lubrication.

CRANKCASE.—Aluminium-alloy casting. Lower half carries the five main crankshaft bearings, which are held in position by separate caps. Top cover is of magnesium-alloy stoutly ribbed to resist deflection.

VALVE GEAR.—Fully enclosed. One inlet and one exhaust valve to each cylinder. Sodium-cooled exhaust valves are used in the Series 10 Mk. 2 and Series 8. Operation by steel rockers, tubular steel push-rods, and steel tappets off camshaft running in five bearings on port side of engine. The camshaft is driven by spur-gears from rear end of crankshaft.

INDUCTION.—Claudel-Hobson AI.48 down-draught carburettor. Two position independent control change-over flap enables warm air to be selected by pilot under icing conditions. Altitude control is provided by an air valve in carburettor, operated from cockpit Twin D.H. A.C. fuel pumps complete with hand-priming levers and remote controls for carburettor flooder fitted to port side of the crankcase and driven by cams from camshaft.

IGNITION.—Two B.T.H. magnetos mounted in inverted position on either side of rear cover. Impulse starter coupling on starboard magneto. Ignition equipment can be supplied screened or unscreened as required.

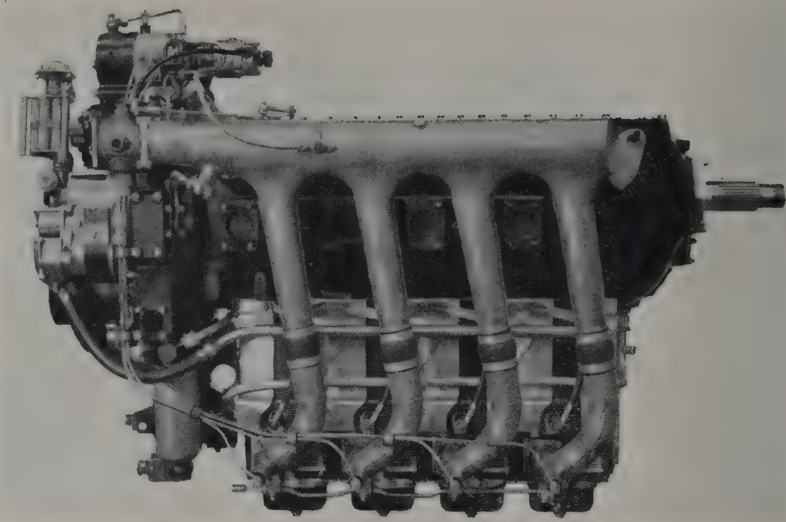
LUBRICATION.—Dry sump system. Engine-driven gear-type pump delivers at a pressure of 40 to 45 lb. per sq. in. (2.81 to 3.16 kg./cm.^{2}) to an Auto Klean-filter. Crankshaft, connecting-rods, camshaft and timing gear are pressure-fed from the main oilway. Cylinders lubricated by splash from connecting rod big-ends. Secondary external oil pipe lubricates all accessory drives and bearings on rear cover above crank-shaft gear. Remaining gears and bearings in lower part of cover lubricated by splash oil from magneto gears and leakage past idler gear bushes which receive pressure oil from rear main bearings. Valve rocker gear lubricated separately by splash from rocker covers which are filled with oil to prescribed level.

ACCESSORIES.—The following accessories are driven from rear of crankshaft:—Vacuum pump, generator up to 500 watts, and there is provision for an electric or cartridge starter driving through a 12-jaw dog.

COOLING.—Same as for Gipsy Queen.

AIRSCREW DRIVE.—Direct. Left-hand tractor. Provision for fixed-pitch wood or metal airscrew of approved design or D.H. manually-operated variable-pitch airscrew, (15° pitch range), on No. 1 SBAC parallel-splined shaft.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.



The 200 h.p. de Havilland Gipsy Major 200 engine.

THE DE HAVILLAND GIPSY MAJOR 200.

The Gipsy Major 200, which is suitable for both fixed and rotary wing application, makes use of Gipsy Queen 30/70 Series cylinder heads and barrels, has an entirely new crankcase and accessory layout, and is fitted with S.U. fuel injection.

TYPE.—Four-cylinder in-line inverted air-cooled.

CYLINDERS.—Bore 4.725 in. (120 mm.). Stroke 5.905 in. (150 mm.). Swept volume 416 cub. in (6.79 litres). Compression ratio 7.25 : 1. Barrels machined all over from carbon steel forgings. Working portion of bore hard chromed. Barrel spigots into crankcase and aluminium head clamped to barrel and crankcase by four long steel studs.

PISTONS.—Fully skirted type of light alloy. Three rings, two compression and one scraper. Plain gudgeon-pins retained by circlips and washers.

CONNECTING RODS.—Machined all over from steel forgings. Big-end bearings of thin-wall lead-bronze type. Small-ends are phosphor-bronze-bushed.

CRANKSHAFT.—Machined all over from nickel-chrome steel forging. Five thin-wall steel-backed lead-bronze-lined bearings.

CRANKCASE.—Magnesium-alloy, stiffened by cross-webs and cross-bolted.

VALVE GEAR.—Fully-enclosed. One inlet and one exhaust valve per cylinder. Exhaust valves sodium-cooled. Inlet valve seats peened, exhaust valve seats screwed

THE DE HAVILLAND GIPSY QUEEN AND GIPSY MAJOR ENGINES.

Engine Type	Gipsy Queen 30 Mk. 2	Gipsy Queen 70-4	Gipsy Queen 70 Mk. 2	Gipsy Major 10 Mk. 2	Gipsy Major 200
Take-off Power	240-250 h.p. at 2,500 r.p.m. at sea level Fuel consumption 18.75-19.5 gals. (85.1-88.5 litres) per hr.	325-340 h.p. at 2,800 r.p.m. at sea level Fuel consumption 32.75 gals. (147.3 litres) per hr.	365-380 h.p. at 3,000 r.p.m. at sea level Fuel consumption 36.5-38 gals. (161.3-168 litres) per hr.	139-145 h.p. at 2,550 r.p.m. at sea level Fuel consumption 11.0-11.5 gals. (50-52.2 litres) per hr.	192-200 h.p. at 2,600 r.p.m. at sea level Fuel consumption 14.4-15 gals. (65.4-86.2 litres) per hr.
Maximum Continuous Power	240-250 h.p. at 2,500 r.p.m. at sea level Fuel consumption 18.75-19.5 gals. (84.3-87.7 litres) per hr.	316-330 h.p. at 2,600 r.p.m. at 5,000 ft. (1,525 m.) Fuel consumption 23.5-24.5 gals. (106.7-111.2 litres) per hr.	341-355 h.p. at 2,700 r.p.m. at 4,250 ft. (1,296 m.) Fuel consumption 31.6-32.9 gals. (142.2-148 litres) per hr.	136-142 h.p. at 2,400 r.p.m. at sea level Fuel consumption 10.75-11.25 gals. (48.3-50.6 litres) per hr.	186-194 h.p. at 2,500 r.p.m. at sea level Fuel consumption 13.9-14.4 gals. (63.2-65.6 litres) per hr.
Maximum Weak Mixture Power	206 h.p. at 2,500 r.p.m. at 2,900 ft. (884 m.) Fuel consumption 12.3-12.9 gals. (55.9-58.5 litres) per hr.	265 h.p. at 2,400 r.p.m. at 8,000 ft. (2,440 m.) Fuel consumption 17.5 gals. (79.5 litres) per hr.	265 h.p. at 2,400 r.p.m. at 8,000 ft. (2,440 m.) Fuel consumption 16.8-17.5 gals. (75.6-78.7 litres) per hr.	125 h.p. at 2,300 r.p.m. at 3,000 ft. (915 m.) Fuel consumption 8.85-9.0 gals. (39.8-40.5 litres) per hr.	160-167 h.p. at 2,500 r.p.m. at sea level Fuel consumption 9.2-9.6 gals. (41.6-43.5 litres) per hr.
Weight dry (including cooling scoops, baffles and fuel-pump unit)	525 lb. (238.3 kg.) + 2½%	685 lb. (311 kg.) + 2½%	690 lb. (313 kg.) + 2½%	325 lb. (147.5 kg.) + 2½%	400 lb. ±5 lb. (181.4 kg. ±2.3 kg.
Supercharger gear ratio	—	11.22 : 1	11.22 : 1	—	—
Airscrew gear ratio	—	0.811 : 1	0.711 : 1	—	—
Overall length (from centre-line of airscrew)	61.5 in. (1,562 mm.)	71.75 in. (1,822 mm.)	71.75 in. (1,822 mm.)	42.1 in. (1,070 mm.)	51 in. (1,295 mm.)
Overall width	19.59 in. (497.5 mm.)	19.56 in. (497 mm.)	19.56 in. (497 mm.)	20.1 in. (510 mm.)	16.8 in. (426 mm.)
Overall height	32.99 in. (838 mm.)	33.23 in. (844 mm.)	33.23 in. (844 mm.)	30.6 in. (777 mm.)	29.8 in. (758.5 mm.)
Fuel Grade	Min. Octane 91-96 Max. lead content 5.5 cc. TEL/gal.	Min. Octane 100-130 Max. lead content 5.5 cc. TEL/gal.	Min. Octane 100-130 Max. lead content 5.5 cc. TEL/gal.	Min. Octane 80 Max. lead content 5.5 cc. TEL/gal.	Min. Octane 100-130 Max. lead content 5.5 cc. TEL/gal.

into cylinder heads. Camshaft in lower port side of crankcase driven from crankshaft through compound idler gear.

INDUCTION.—S.U. direct fuel injection into inlet ports.

IGNITION.—Two B.T.H. Type SG4 magnetos, with impulse starter on each, mounted on wheelcase. Two K.L.G. KA1 sparking-plugs per cylinder. Tecalemit ignition harness.

LUBRICATION.—Dry sump system. One pressure, two scavenge pumps.

AIRSCREW DRIVE OR DRIVE FOR HELICOPTER PRIMARY GEAR-BOX.—Direct. Direction counter clockwise seen from rear. S.B.A.C. No. 1 airscrew shaft.

ACCESSORIES. Engine accessories include S.U. fuel injector pump (1 : 1 gear ratio). Plessey F.1 Mk. 3M fuel pump (0.75 : 1 gear ratio), and Smith's 122-RV/SP engine speed indicator and generator (1 : 1 gear ratio). Aircraft accessories include Hymatic SH6/7C air compressor or, alternatively, Lockheed hydraulic pump (gear ratio 0.548 : 1), Plessey B. 3X/Mk. 2 vacuum pump (1.27 : 1 gear ratio), and Rotax B.2001-2F generator (2.55 : 1 gear ratio).

STARTING.—Plessey S3 Mk. 3 cartridge (helicopter and fixed-wing installation) or B.T.H. electric (fixed-wing).

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

ROLLS-ROYCE

ROLLS-ROYCE, LTD.

HEAD OFFICE: DERBY.

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LONDON OFFICE: 14-15, CONDUIT STREET, W.1.

Established: March 15, 1906.

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Chief Engineer, Aero Engine Division: A. A. Lombard, F.R.Ae.S.

Although the productive capacity of Rolls-Royce is now almost entirely devoted to gas-turbine engines of both the turbojet and turboprop types, Rolls-Royce liquid-cooled piston engines of the Merlin and Griffon types are still in widespread use. The Merlin is no longer in production, but the Griffon is still being manufactured.

Details of Rolls-Royce gas-turbine engines will be found in Part I of this section.

THE ROLLS-ROYCE GRIFFON.

The Griffon 57 powers the Avro Shackleton, a four-engined long-range reconnaissance aircraft which is in production for the R.A.F.

The Griffon 74 which powers the Fairey Firefly was designed to meet the requirements of the Royal Navy, the Royal Australian Navy and the Royal Netherlands Navy. It is fitted with a Rolls-Royce injection pump by means of which fuel is discharged into the eye of the supercharger.

The specification that follows is generally applicable to all Griffon engines, but it should be noted that all marks of Griffon below the Mark 60 Series have two-speed single-stage superchargers and those above this mark number two-speed two-stage superchargers.

TYPE.—Twelve-cylinder 60° Vee liquid-cooled.

CYLINDERS.—Bore 6.0 in. (152.4 mm.). Stroke 6.6 in. (167.64 mm.). Swept volume 2,240 cub. in. (36.7 litres). Two blocks of six cylinders, with separate light alloy cylinder-head. Separate high carbon steel liners. Heads carry renewable stellited valve seatings. Inlet and exhaust valve guides of cast iron and lead-bronze respectively.

PISTONS.—R.R.59 alloy. Two compression rings and two drilled and grooved scraper rings, one above and one below gudgeon-pin. Fully-floating gudgeon-pin located by spring wire circlips.

CONNECTING RODS.—Nickel steel forgings machined all over. Each assembly consists of plain rod and forked rod, the latter carrying a nickel steel bearing block which retains a split flanged thin steel shell lined with lead-bronze which runs directly on crankpin. Similar split bearing shells on the plain rod work on outer surface of the forked rod block. Small end of each connecting-rod houses a fully-floating bronze bush.

CRANKSHAFT.—One-piece six-throw machined forging of nitrogen-hardened chrome-molybdenum steel. Drive to reduction gear pinion by serrated flange bolted to front end of shaft. Rear end of shaft is connected by flexible torsion shaft to supercharger driving gear and also provides drives to auxiliary gearbox, oil pumps, coolant pumps, fuel pump, tachometer and constant-speed unit.

CRANKCASE.—In two halves. Both castings of aluminium-alloy. Upper portion carries cylinders and crankshaft main bearings. Front of crankcase forms integrally the rear housing of the airscrew reduction gear and also contains camshaft and starter motor drives. Lower portion forms engine sump and contains oil pump assembly.

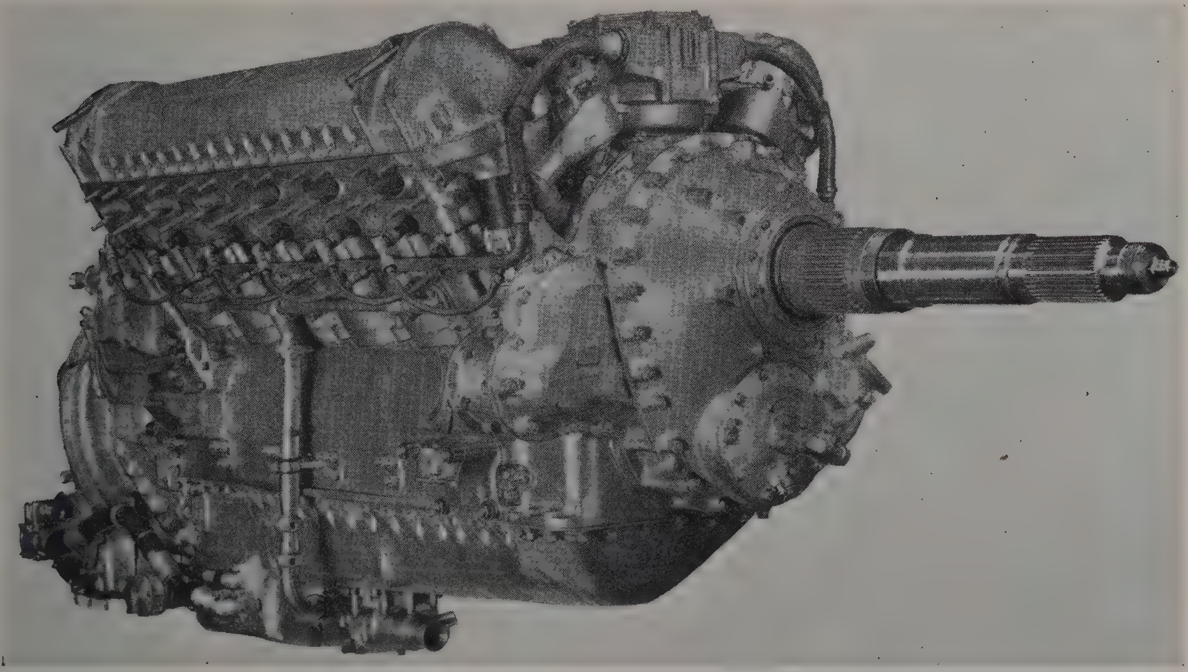
VALVE GEAR.—Two inlet and two exhaust valves per cylinder. Inlet and exhaust valves are of K.E.965 steel, a protective layer of Brightray covering whole of combustion face and seat of the exhaust valve and seat only of the inlet valve. Sodium-cooled exhaust valves. Single central camshaft to each cylinder block operates both inlet and exhaust valves.

INDUCTION.—On later marks of Griffon R.R. injection-pump and combined feed-pump and metering device in one unit. Metering is effected by two jets in parallel, whose free areas are controlled by taper needles, one needle being operated by a capsule subject to boost-pressure and atmospheric pressure (exhaust back-pressure) and the other by a temperature sensitive device in induction pipe. Pressure difference across the jets is controlled by engine speed by means of a flexible diaphragm connected to a needle valve and loaded by a centrifugal governor driven by the engine on same shaft as feed-pump.

SUPERCHARGER.—Both single and two-speed two-stage superchargers are of the two-speed centrifugal type, the change-speed mechanism of which is operated by an automatic change-over mechanism incorporating an electric-hydraulic system operated by an atmospherically-controlled aneroid. Delivery pressure of the supercharger is controlled by an automatic servo mechanism coupled through a differential linkage to the throttle so that a constant-boost-pressure is maintained at altitude up to full throttle conditions for a fixed position of the pilot's lever.

IGNITION.—Two twelve-cylinder magnetos in one unit and mounted in the Vee directly behind the reduction-gear housing. Driven by bevel gears and an inclined shaft from the port camshaft drive.

LUBRICATION. — Dry - sump system. One pressure and two scavenge gear type pumps. Pressure pump delivers oil to two relief valves in one unit which controls oil pressure to a high and low pressure system. Any excess oil is spilled back directly into crankcase. High pressure system feeds



The 2,500 h.p. Rolls-Royce Griffon 57 engine with two-speed single-stage supercharger and gearing for contra-rotating airscrews, four of which power the Avro Shackleton.

ROLLS-ROYCE GRIFFON ENGINES.

Bore × Stroke: 6 in. × 6.6 in. (152.5 mm. × 167.6 mm.). Capacity: 2,240 cu. in. (36.7 litres).

Engine	Take-off Power	International Rating	Maximum Power	Dry Weight (plus 2½% tolerance)	Airscrew Gear Ratio	Compression Ratio	Remarks
Griffon 57 and 5900	2,500 h.p. at 2,750 r.p.m.	1,660 h.p. at 2,600 r.p.m. at 5,500 ft. (1,680 m.) and 1,540 h.p. at 2,600 r.p.m. at 12,550 ft. (3,830 m.)	2,030 h.p. at 2,750 r.p.m. at 1,760 ft. (540 m.) and 1,850 h.p. at 2,750 r.p.m. at 9,750 ft. (2,970 m.)	Mk. 57 2,115 lb. (960 kg.) Mk. 5900 2,025 lb. (919 kg.)	Mk. 57 .4423 : 1 Contra-rotating Mk. 5900 0.511 : 1	6.00 : 1	Mk. 57 has contra-rotating airscrews and is installed in Avro Shackleton. Mk. 5900 has normal single-spur reduction gear.
Griffon 74	2,004 h.p. at 2,750 r.p.m.	1,505 h.p. at 2,600 r.p.m. at 7,500 ft. (2,280 m.) and 1,420 h.p. at 2,600 r.p.m. at 20,500 ft. (6,250 m.)	2,045 h.p. at 2,750 r.p.m. at sea level and 2,245 h.p. at 2,750 r.p.m. at 9,250 ft. (2,820 m.)	2,100 lbs. (953 kg.)	.45 : 1	6.00 : 1	Installed in Firefly 5 and 6.

the crankshaft journal bearings, connecting-rod bearings and constant-speed unit. High pressure oil is also taken from delivery side of main pressure pump for operating change-speed mechanism for two-speed supercharger drive. Low pressure system is used for feeding oil to camshaft and rocker mechanism oil jets feeding airscrew reduction gears, supercharger drive gears, and various other bearings throughout engine.

Coolant System.—Coolant employed is mixture of 70% water and 30% ethylene glycol. Coolant is circulated by centrifugal-type pump to cylinder blocks and from cylinder blocks to small-capacity header-tank and from header tank via a radiator to coolant-pump inlet. Loaded relief valve in header tank seals whole coolant system up to a predetermined pressure. This raises boiling point of coolant, and permits use of smaller radiators. Header tank relief valve also incorporates suction-operated valve which admits air, if for any reason pressure falls below atmospheric.

Coolant System (Griffon 57).—Closed circuit shunt system. With this system pressure loss on inlet side of coolant pump which would upset mass circulation is eliminated. Coolant flows from pump through cylinder blocks to swirl-type outlets at top of blocks, then to radiator and back to pump. Swirl outlets separate vapour from coolant and pass it to header tank, which acts as reservoir for coolant and is connected to venturi at pump inlets. Should any decrease in pressure occur at pump due to cavitation it is immediately restored by flow of coolant from header tank to venturi.

Intercooler System (Griffon 74).—Coolant employed is mixture of 70% water and 30% ethylene glycol which is circulated by means of centrifugal pump from header tank through a radiator in jacket situated between two stages of the supercharger and to the intercooler matrix, placed between supercharger and induction pipe, and thence back to header tank. This system which is entirely independent of main engine system is pressurised and incorporates similar design of header tank, relief valve and radiator-cooling air control as on main system, but no thermostat. Heat exchange from coolant is carried out by an independent radiator in aircraft system in normal manner.

Starting. The starting system on all Griffons except Mk. 57 is of Coffman combustion type. On Griffon 57 Rotax direct-turning 24-volt type C.3304 starter, complete with Bendix engaging clutch and gears mounted in same position as combustion starter.

Auxiliaries.—All the aircraft service accessories are mounted on separate gearbox on bulkhead and driven by shaft through universal joints from top of wheelcase. This gearbox has its own independent lubrication system and supply.

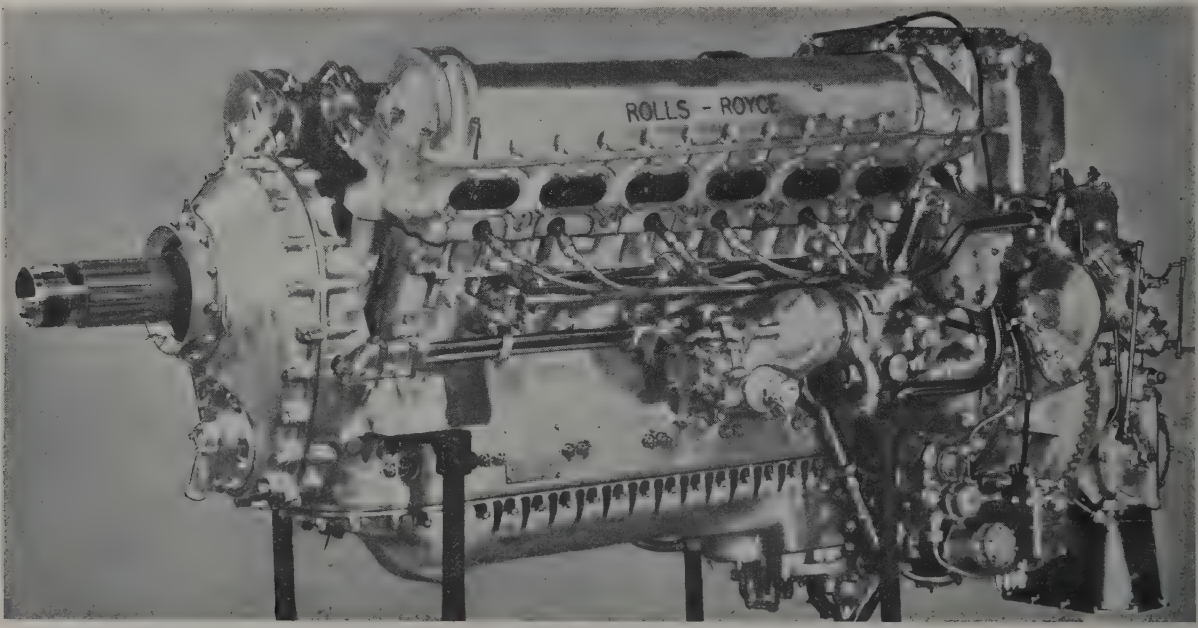
Airscrew Drive (All except Mk. 57).—Left-hand tractor. Single spur reduction gear. Hollow driving pinion mounted in two roller bearings is concentric with, and is driven by, hollow coupling shaft serrated at both ends. One end engages with a serrated driving ring on crankshaft and forward end with internal serrations on driving pinion. This coupling shaft insulates reduction gear unit from crankshaft loadings and torsional vibrations. Hollow airscrew shaft has an integral flange which is bolted to ring gear driven by pinion, and is mounted in roller-bearings, axial thrust being taken in either direction by ball thrust-bearing.

Airscrew Drive (Griffon 57).—Contra rotating. Drive from crankshaft is through coupling shaft to double pinion. Rear pinion drives gear wheel bolted to inner airscrew shaft which is thus driven in opposite direction to that of crankshaft. Front pinion drives an idler wheel which in turn drives a gear wheel bolted to outer airscrew shaft. Two shafts are connected co-axially and reversing thrust loads are taken by thrust bearing mounted between two shafts. Primary thrust taken by second bearing located on outer shaft and housed in reduction gear casing. Shafts are S.B.A.C. size 4 and 6 and, in addition, inner shaft is increased in length for use of feathering airscrews for multi-engined aircraft.

Weights and Performance.—See Table.

THE ROLLS-ROYCE MERLIN.

To provide a clear distinction between military Merlin engines and civil types, the mark numbers for the civil engines begin at 500 and 600. The 500 series covers the two-speed single-stage supercharged civil Merlin engines, and the 600



The 1,725 h.p. Rolls-Royce Merlin 620 civil engine which was specially designed to power the Canadair Four.

and 700 Series cover civil engines equipped with two-speed two-stage superchargers.

Merlin 724 engines power the Trans-Canada Air Lines' fleet of "North Star" airliners while the Canadair Four airliners in service with the British Overseas Airways Corporation are powered with Merlin 724-1C engines.

The Merlin 140 powers the Short Sturgeon and is equipped to drive contra-rotating airscrews. It has fuel-injection and an updraught air intake.

Full constructional details of the Merlin have appeared in previous editions of this Annual. The principal characteristics of the Merlin engines in current use will be found in the table below.

ROLLS-ROYCE MERLIN ENGINES.

Bore × Stroke : 5.4 in. × 6 in. (137.3 mm. × 152.5 mm.). Capacity : 1,649 cu. in. (27 litres).

Engine	Take-off Power	Emergency Maximum Power	Maximum Climbing Power	Continuous Cruising Power	Dry Weight	Airscrew Gear Ratio	Remarks
Merlin 140	1,725 h.p. at 3,000 r.p.m.	1,780 h.p. at 3,000 r.p.m. at 4,500 ft. (1,370 m.) and 1,650 h.p. at 3,000 r.p.m. at 16,750 ft. (5,110 m.)	1,410 h.p. at 2,850 r.p.m. at 10,000 ft. (3,050 m.) and 1,315 h.p. at 2,850 r.p.m. at 20,500 ft. (6,250 m.)	1,200 h.p. at 2,650 r.p.m. at 10,250 ft. (3,130 m.) and 1,185 h.p. at 2,850 r.p m. at 23,750 ft. (7,245 m.)	1,780 lbs. (808 kg.)	.512 : 1 (Contra-rotating)	Two-speed two-stage supercharger. Inter-cooled. R.R.-S.U. fuel injection pump. R.R. accessory gear-box.
Merlin 500	1,610 h.p. at 3,000 r.p.m.	1,635 h.p. at 3,000 r.p.m. at 2,250 ft. (690 m.) and 1,510 h.p. at 3,000 r.p.m. at 9,250 ft. (2,820 m.)	—	1,080 h.p. at 2,650 r.p.m. at 8,750 ft. (2,670 m.) and 1,015 h.p. at 2,650 r.p.m. at 15,500 ft. (4,730 m.)	1,525 lbs. (692 kg.)	.420 : 1 (R.H. tractor)	Two-speed single-stage supercharger. S.U. anti-"G" float type carburettor.
Merlin 621	1,725 h.p. at 3,000 r.p.m.	1,770 h.p. at 3,000 r.p.m at 4,000 ft. (1,220 m.) and 1,655 h.p. at 3,000 r.p.m. at 16,500 ft. (5,030 m.)	—	1,160 h.p. at 2,650 r.p.m. at 10,000 ft. (3,050 m.) and 1,160 h.p. at 2,850 r.p.m. at 23,500 ft. (7,170 m.)	1,700 lbs. (772 kg.) (Merlin 620) 1,740 lbs. (790 kg.) (Merlin 620 and 621)	.4707 : 1 (Merlin 620) .420 : 1 (Merlin 600 and 621)	Two-speed two-stage supercharger. Inter-cooled. Charge heater. R.R. S.U. fuel injection pump. R.R. accessory gear-box. Electric starter.
Merlin 622 623, 624, 625 and 626	1,760 h.p. at 3,000 r.p.m.	1,810 h.p. at 3,000 r.p.m. at 3,750 ft. (1,145 m.)	—	1,500 h.p. at 2,850 r.p.m. at 7,750 ft. (2,360 m.) and 1,420 h.p. at 2,850 r.p.m. at 18,700 ft. (5,700 m.)	Same as 620	for Merlin and 621	Take-off power quoted is at 68°C. charge temperature. Merlin 625 and 626 have full-depth intercooling.
Merlin 724 and 724-1C	1,760 h.p. at 3,000 r.p.m.	—	—	1,500 h.p. at 2,850 r.p.m. at 7,750 ft. (2,260 m.) and 1,400 h.p. at 2,850 r.p.m. at 18,750 ft. (5,720 m.)	1,790 lbs.	.420 : 1	Two-speed two-stage supercharger. Inter-cooling and charge-heating. S.U. single-point injection pump. Electric starter. Merlin 724-1C has "cross-over" exhaust system.

CZECHOSLOVAKIA

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THE WALTER MIKRON III.

Type.—Four-cylinder inverted in-line air-cooled, ungeared.

Cylinders.—Bore 90 mm. (3.54 in.). Stroke 96 mm. (3.78 in.). Total capacity 2.44 litres (149 cub. in.). Compression ratio 6 : 1. Steel cylinders with cooling fins machined from solid. Cylinder bores nitrided. Detachable cylinder-heads are aluminium-alloy castings. Cylinder-head assembly attached to the crankcase by four cylinder holding-down studs.

Pistons.—Aluminium-alloy castings. Three compression rings and one scraper ring. Gudgeon-pins secured by spring circlips.

Valve Gear.—One inlet and one exhaust valve per cylinder, of special heat-resisting alloy steel with nitrided stems. Double valve springs. Valves operated by the camshaft through push-rods and rocker-arms. Rockers fitted with needle bearings, with rollers for the valves and valve-clearance adjusting-screws at the push-rod ends. Valve and rocker mechanism on each cylinder enclosed in Elektron cover.

Connecting Rods.—H-section, stamped from aluminium-alloy, polished. Split big-ends provided with steel-backed lead-bronze bearings.

Crankshaft.—Forged from special chrome-vanadium steel, machined all over. Crank pins and journals nitrided. Carried in five steel-backed lead-bronze bearings and a ball thrust-bearing at the front end.

Crankcase.—Heat treated magnesium-alloy (Electron) casting.

Lubrication.—Dry-sump pressure lubrication. Double gear-type oil-pump with pressure and scavenge stages located at the rear of the crankcase above the sump. Oil drawn from oil tank by pressure pump, provided with an inlet and a pressure relief valve. Spent oil in sump withdrawn by scavenge pump and returned to oil tank. Union in the pressure line on the crankcase is adapted for pressure-gauge connection. The valve-gear works in an oil bath in each rocker cover box. The lubrication system can be modified on request for aerobatic flying, mainly by the addition of an automatic valve to the scavenge line.

Induction System.—Walter AI-37-A down-draught carburettor with manual mixture control. Cast induction manifold, pre-heated by exhaust gases, fitted with a drain valve and, on request, with two priming jets. Fuel supplied to the carburettor by double diaphragm Walter 2M 50 fuel pump, fitted with a pressure-gauge connection.

Ignition.—Two Scintilla Vertex magnetos, OAF 4R 401Z39 (port) and OAF 4R 601 Z39 (starboard) with automatic sparking advance-placed side-by-side in a hanging position on the crankcase. Starboard magneto provided with impulse unit. Sparking plugs 12 × 1.25 mm. (.5 × .07 in.).

Cooling.—Air scoop with an easily removable sliding inspection strip for access to the sparking plugs fitted on port side, with cylinder baffles on starboard side.

Starting.—Hand-starter type Walter R15, with crank, supplied on request.

Accessory Drives and Equipment.—At the rear end of the crankcase. On left-hand side a tachometer drive, D. of R. clockwise, 1/2 engine speed, on right-hand side a fuel-pump mounting-flange and drive, D. of R. clockwise, 1/2 engine speed.

Engine Mounting.—Engine mounted elastically by means of four engine-bearer feet with rubber vibration dampers.

Airscrew Drive.—Direct, left-hand tractor (when looking at the engine from the rear). Boss for fixed-pitch airscrew normally used. Keyed to the tapered crankshaft front end and retained by a nut. Airscrew hub fixed to the boss by means of a retaining plate and six retaining bolts.

Dimensions.—
- Overall length with airscrew boss 925 mm. (36.42 in.).
- Overall width without bearer feet 350.7 mm. (13.8 in.).
- Overall height 530 mm. (20.87 in.).

Weight Dry (including normal accessories).—62 kg. (137 lb.).

Performance.—
- Rated output at sea level 65 b.h.p. at 2,600 r.p.m.
- Cruising output 48 b.h.p. at 2,350 r.p.m.
- Fuel consumption at rated sea level power 245 gr. (.54 lb.) per h.p./hr.
- Fuel consumption at cruising power 225 gr. (.49 lb.) per h.p./hr.
- Oil consumption 2-8 gr./h.p./hr. (.0044-.018 lb.) per h.p./hr.

THE WALTER MINOR 4-III.

Type.—Four-cylinder inverted in-line air-cooled, ungeared.

Cylinders.—Bore 105 mm. (4.13 in.). Stroke 115 mm. (4.53 in.). Total capacity 3.98 litres (247.87 cub. in.). Compression ratio 6 : 1. Steel cylinders with cooling fins machined from solid. Cylinder bores nitrided. Detachable cylinder-heads are aluminium-alloy castings. Cylinder and head assembly attached to crankcase by four cylinder holding-down studs.

Pistons.—Aluminium-alloy stampings. Three compression rings and one scraper ring. Gudgeon-pins secured by spring-circlips.

Valve Gear.—Same as for Mikron III.

Connecting Rods.—H-section, stamped from aluminium-alloy, polished. Split big-ends provided with steel-backed lead-bronze bearings.

Crankshaft.—Forged from special chrome-vanadium steel, machined all over. Crank-pins and journals nitrided. Carried in five steel-backed lead-bronze bearings and a ball thrust-bearing at the front end.

Crankcase.—Heat-treated magnesium-alloy casting.

Lubrication.—Dry sump pressure lubrication. For description see Mikron III.

Induction System.—Walter 45 down-draught carburettor with manual mixture control, acceleration pump, special jet for inverted flight and choke. Cast induction manifold, pre-heated by exhaust gases, fitted with two priming jets and with 4 drain valves. A hot and cold air intake controllable from the cockpit, fitted on special request. Cold air passes directly to the carburettor, warm air is drawn from the cylinders through a flame trap. Fuel supplied to the carburettor by double diaphragm Walter 2M 50 fuel-pump fitted with a pressure-gauge connection.

Ignition.—Dual non-shielded ignition; shielded ignition optional. Two Scintilla Vertex magnetos OAF 4R 401 Z39 (port) and OAF 4R 601 Z39 (starboard) with automatic sparking advance. Magnetos placed side-by-side in a hanging position at the rear of the crankcase. Starboard magneto provided with impulse unit. Sparking plugs 12 × 1.25 mm.

Cooling.—Cylinder cooling air-scoop and baffle plates as for Mikron III.

Starting.—Electric and hand starter with crank, type Walter RE 25, or electric starter Walter P320, both supplied on request.

Accessory Drives and Equipment.—On the rear end of the crankcase; left-hand a tachometer drive (D. of R. clockwise, 1/2 engine speed); right-hand a fuel-pump mounting-flange and drive (D. of R. clockwise, 1/2 engine speed). On the port side of the crankcase can be fitted either a directly-driven 24-volt 300 watt. generator.

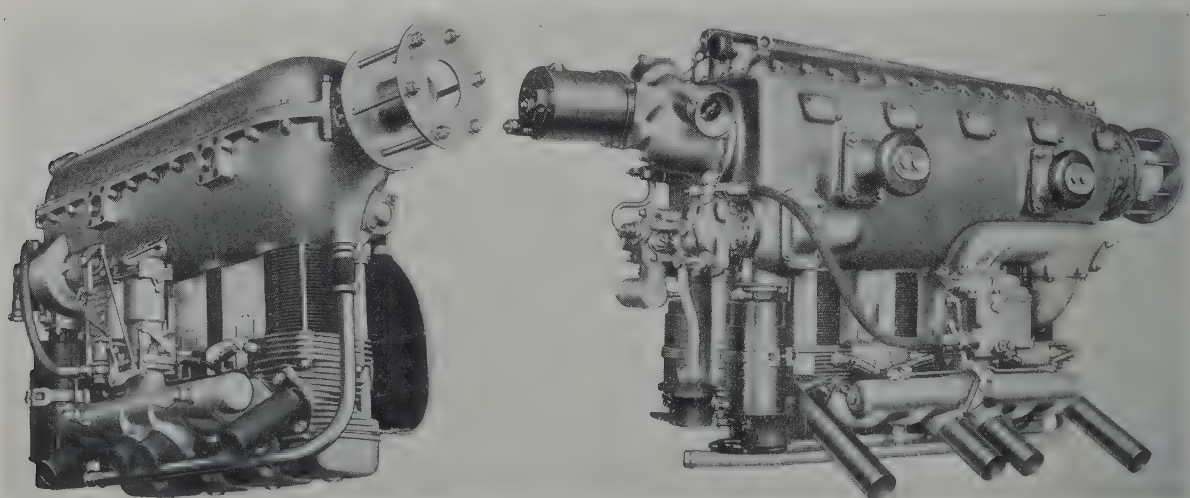
Mounting.—Four engine bearer feet with rubber vibration dampers, supplied on special request.

Airscrew Drive.—Direct, left-hand tractor (when looking at the engine from the rear). Boss for wooden fixed-pitch airscrew is normally used. Keyed to the tapered crankshaft front-end and retained by a nut. Airscrew hub attached to boss by retaining plate and eight retaining bolts. VP-airscrew Walter V401 mechanically operated or Walter V401E electrically operated, both optional.

Dimensions.—
- Overall length with airscrew boss 1,032 mm. (40.63 in.).
- Overall width without bearer feet 399 mm. (15.7 in.).
- Overall height 632 mm. (24.9 in.).

Weight Dry (including normal accessories).—90.3 kg. (199 lb.).

Performance.—
- Rated output at sea level 105 b.h.p. at 2,500 r.p.m.
- Cruising output 80 b.h.p. at 2,300 r.p.m.
- Fuel consumption at rated sea level power 245 gr. (.54 lb.) per h.p./hr.
- Fuel consumption at cruising power 225 gr. (.49 lb.) per h.p./hr.
- Oil consumption 2-8 gr. (.0044-.018 lb.) per h.p./hr.



The 65 h.p. Walter Mikron III (left) and 105 h.p. Walter Minor 4-III (right) inverted air-cooled engines.

FRANCE

POTEZ

SOCIÉTÉ DES AVIONS ET MOTEURS HENRY POTEZ.

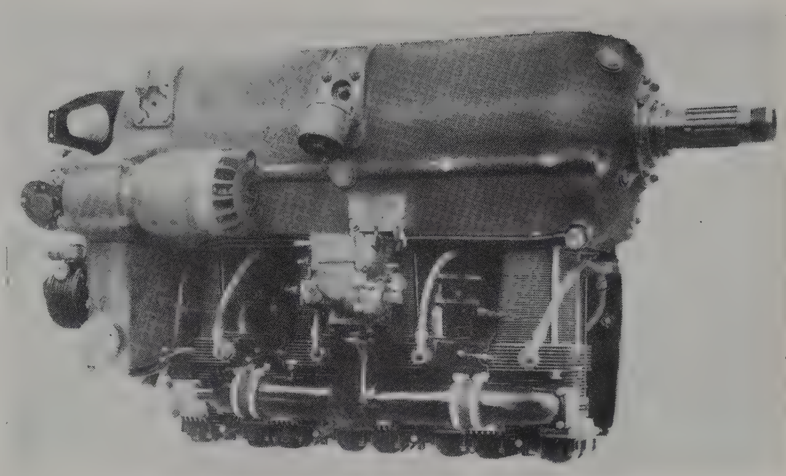
Head Office : 46, Avenue Kléber, Paris (XVIe).

Experimental Laboratory (Design and Development) : 37 Rue Jean-Jacques Rousseau, Suresnes (Seine),

Production Factory : 204 Rue Henri Barbusse, Argenteuil (Seine-et-Oise).

Based on the designs and development work of its long-established Engine Design Laboratory (L.E.M.), the Société des Moteurs Henry Potez is producing aircraft piston engines with new facilities at Argenteuil, in north-west Paris.

Potez is concentrating on the development and production of a range of four, six, and eight cylinder engines which are the outcome of a programme introduced before the war. All engines use the same basic cylinder of 125 mm. × 120 mm. (4.92 in. × 4.72 in.) and all but the 8-D 40 which is still in the design stage, have been type-tested and extensively flight-tested. Direct injection has been introduced with Type 6-D 30.



The 160 h.p. Potez 4-D 01 four-cylinder inverted engine.

THE POTEZ 4-D 01.

Type.—Four-cylinder in-line inverted, air-cooled.

Cylinders.—Bore 125 mm. (4.92 in.). Stroke 120 mm. (4.72 in.). Swept volume 5.85 litres (352 cub. in.). Compression ratio 7 : 1. Nitrided steel cylinder barrel with Y-alloy die-cast cylinder heads secured by four long bolts screwing into crankcase.

Pistons.—Y-alloy die forging. Two compression and one double scraper rings above gudgeon-pin, one scraper ring below. Floating gudgeon-pin.

Connecting Rods.—I-section aluminium-alloy forgings with split big-ends and split steel-backed lead-bronze lead-plated bearing. Assembly by four chrome-nickel steel bolts. Little-end floating directly on gudgeon-pin.

Crankshaft.—Nickel - chrome - molybdenum steel, forged and machined. Four-throw, on six bearings. Deep-groove ball-bearing at front, remainder are steel-backed lead-bronze lead-lined. Solid splined airscrew shaft.

Crankcase.—Aluminium-alloy casting with duralumin top cover. Five duralumin forged bearing caps secured by chrome-nickel steel studs. Chrome-nickel steel through-bolts at centre bearing cap. Cast magnesium-alloy oil sump in rear section of case.

Valve Gear. — Two symetrically - inclined valves of nitrided austenitic steel per cylinder. Stellited sodium-cooled exhaust valves. Tin-sillicon-supronickel shrunk-in valve-seats. Single camshaft in crankcase operates all valves through roller tappets, push-rods and adjustable rocker-arms. Two shot-peened vanadium steel valve springs per cylinder.

Induction.—One Zenith inverted 60 IDC.04 carburettor with automatic altitude control. Exhaust-heated muff on induction pipe. Pressure feed by one A.M. pump type CM12.

Fuel.—80 octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

Ignition.—One double RB type J4A magneto. BG screened harness and two BG type 401 MN spark-plugs per cylinder. Potez patented automatic spark advance linked with throttle.

Lubrication.—Dry sump type. One pressure and two scavenge pumps, fore and aft. Normal oil pressure 3.5-5.0 kg./cm.² (49.7-71.0 lb./sq. in.). Minimum temperature 50°C. Maximum temperature 95°C. at inlet, 100°C. at outlet.

Airscrew Drive.—Direct right-hand drive. Splines conforming to B.N.Aé. 212.01. Provision for electric or hydraulic variable-pitch airscrew.

Accessories.—Drive for 24-volt 600-watt electric generator on left rear side of crankcase. Ratio 2.48 : 1. Tachometer drive on rear of crankcase. Ratio 1 : 2. Vacuum pump and hydraulic pump drives on rear of sump case. Ratios 1.06 : 1 and 0.67 : 1 respectively.

Starter.—Potez electric 24-volt direct-drive starter.

Mountings.—Three-point flexible mountings, one on each side of crankcase on C.G. and one aft.

Cooling.—Three inter-cylinder deflectors, one rear deflector, and one side chute in two pieces, one movable. Maximum temperatures (at 2.400 r.p.m.) 250°C. cylinder heads, 140°C. cylinder barrels.

Dimensions.—
Overall length 1,207.5 mm. (47.5 in.).
Overall height 668.5 mm. (26.3 in.).
Overall width 510 mm. (20.1 in.).

Weight Dry (without accessories).—
143 kg. (314.6 lb.).
Weight of accessories mentioned 18.7 kg. (41.2 lb.).

Performance.—
Take-off output 160 h.p. at 2,520 r.p.m.
Normal output at sea level 155 h.p. at 2,500 r.p.m.
Max. cruising output 130 h.p. at 2,360 r.p.m.
Economic cruising output 105 h.p. at 2,260 r.p.m.

Consumptions.—
At take-off 245 gr./h.p./hour at normal output (2,500 r.p.m.) 240 gr./h.p./hour.
At max. cruising 215 gr./h.p./hour.
At economical cruising 205 gr./h.p./hour.

THE POTEZ 4-D 31.

This is the previously described 4-D 01 fitted with centrifugal blower mounted horizontally on the crankcase top cover.

The general description of the 4-D 01 applies to this engine except for the following details :—

Cylinder.—Same as for 4-D 01. Cylinder head shrunk on sleeve.

Induction.—Supercharged. Sealed carburettor and pressure pump as for 4-D 01.

Supercharger. — Single - stage centrifugal type. High-strength die-forged aluminium-alloy impeller driven from front end of crankshaft through ground spur teeth, ground zerol bevel gearing and slipping coupling. Ratio 15.51 : 1.

Fuel.—100 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

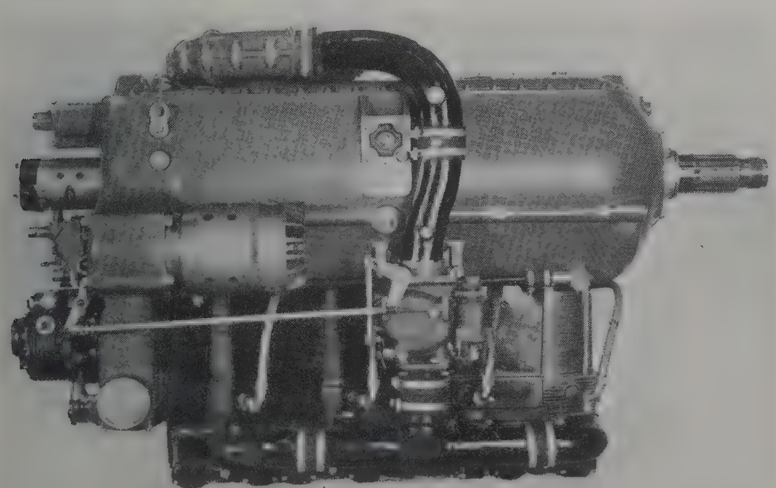
Lubrication.—Same as for 4-D 01. Pressure feed to supercharger drive.

Dimensions.—
Overall length 1,207 mm. (47.5 in.).
Overall width 530 mm. (20.8 in.).
Overall height 720 mm. (28.3 in.).

Weight Dry (without accessories).—
174 kg. (383 lb.).

Performance.—
Take-off output 220 h.p. at 2,400 r.p.m.
Normal output at S/L. 180 h.p. at 2,400 r.p.m.
Normal output at 1,500 m. (5,000 ft.) 188 h.p. at 2,400 r.p.m.
Normal cruising output 160 h.p. at 2,300 r.p.m.
Economic cruising output 105 h.p. at 2,000 r.p.m.

Consumptions.—
At take-off 305 gr./h.p./hour.
At normal output at S/L. 270 gr./h.p./hour.
At normal output at 1,500 m. (5,000 ft.) 270 gr./h.p./hour.
At normal cruising 250 gr./h.p./hour.
At economical cruising 245 gr./h.p./hour.



The 220 h.p. Potez 4-D 31 four-cylinder supercharged engine.

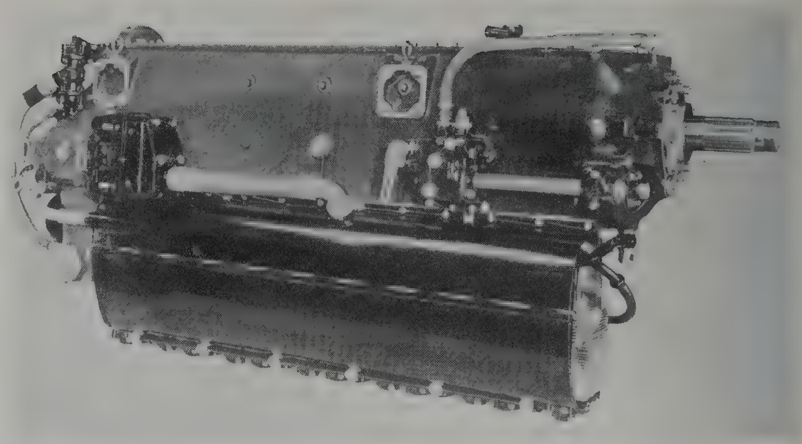
THE POTEZ 6-D 02.

Type.—Six-cylinder in-line inverted air-cooled.

Cylinders.—Same as for 4-D 01 except swept volume 8.83 litres (539 cub. in.).

Pistons and Connecting Rods.—Same as for 4-D 01.

Crankshaft.—Six-throw, nitrided nickel-chrome-molybdenum steel, forged and machined all over. Deep-groove ball thrust bearing and seven steel-back lead-bronze lead-plated bearings. Solid splined airscrew shaft.



The 240 h.p. Potez 6-D 02 six-cylinder inverted engine.

CRANKCASE.—Aluminium-alloy casting with dural flat top cover. Seven dural forged bearing caps secured by two and four chrome-nickel steel studs. Chrome-nickel steel through-bolts at three centre bearing caps. Seven camshaft journals. Cast magnesium-alloy oil sump in rear section of case.

VALVE GEAR.—Same as for 4-D 01.

INDUCTION—Normally aspirated. Two Hobson A.I. 55/J carburettors with automatic altitude correction and enrichment. Fuel feed by AM Type CM 13 pump. Provision for aerobatics.

FUEL.—80 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

IGNITION.—Fully VHF screened. One double RB Type J6A magneto. BG harness and two BG 401 MN spark-plugs per cylinder. Potez patented automatic spark advance linked with throttle.

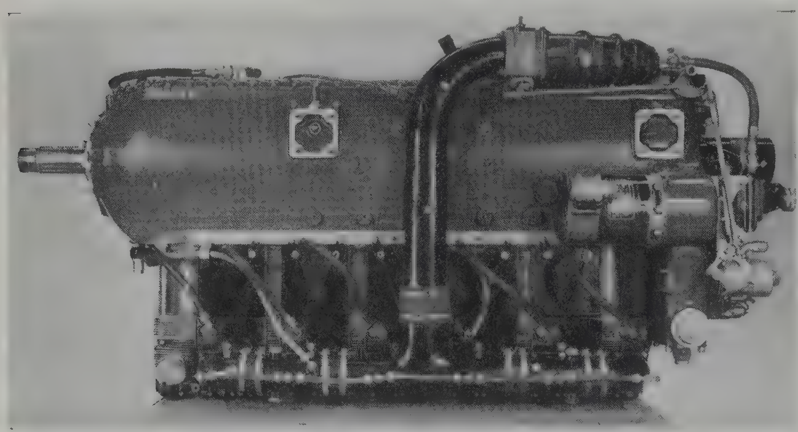
LUBRICATION.—Same as for 4-D 01. Provision for scavenging of crankcase in inverted flight by gravity-sensitive dual valve.

AIRSCREW DRIVE.—Direct, right-hand drive. Splines conforming to B.N.Ae. 212.01. Provision for hydraulic variable-pitch airscrew.

ACCESSORIES.—Drive for 24-volt 1,600-watt electric generator on left side rear of crankcase. Ratio 2.46 : 1 Tachometer drive on rear of crankcase. Ratio 0.5 : 1. Vacuum and hydraulic pump drives on rear of sump case. Ratios 1.07 : 1 and 0.67 : 1 respectively. Hydraulic airscrew regulator on right front side of crankcase. Ratio 0.5 : 1.

STARTING. — Potez electric 24-volt direct starter.

MOUNTING.—Four points, two forward and two aft of G.C.



The 305 h.p. Potez 6-D 30 six-cylinder supercharged engine.

COOLING.—Five inter-cylinder deflectors, one rear deflector and one side chute in two pieces, one movable. Maximum temperatures (at 2,500 r.p.m.) 250°C. cylinder heads, 150C° cylinder barrels.

DIMENSIONS.—
- Overall length 1,550 mm. (61 in.).
- Overall height 668.5 mm. (26.3 in.).
- Overall width 510 mm. (20.1 in.).

WEIGHT DRY.—
- Without accessories 235 kg. (517 lb.).
- Weight of accessories mentioned 17 kg. (37.4 lb.).

POWER RATING.—
- Take-off output 240 h.p. at 2,530 r.p.m.
- Normal output at sea level 230 h.p. at 2,500 r.p.m.
- Max. cruising output 180 h.p. at 2,300 r.p.m.
- Economic cruising output 135 h.p. at 2,100 r.p.m.

CONSUMPTIONS.—
- At take-off 250 gr./h.p./hour.
- At normal output (2,500 r.p.m.) 240 gr./h.p./hour.
- At max. cruising 220 gr./h.p./hour.
- At economical cruising 205 gr./h.p./hour.

THE POTEZ 6-D 30.

This is the above-described 6-D 02 fitted with a centrifugal blower mounted horizontally on the crankcase top-cover. The description of the 6-D 02 applies to this engine except for the following details :—

CYLINDERS.—Same as for 6-D 02. Cylinder-head shrunk-fitted on sleeve.

INDUCTION. — Supercharged. Direct high pressure injection into cylinder head provided by Bronzavia swash-plate six-plunger pump Type 130-604 supported by crankcase at front right side and driven at camshaft speed by level gearing. Fully-automatic mixture control with automatic altitude and temperature controls. One injection nozzle per cylinder. No boost control. One throttle valve at supercharger outlet. First-stage fuel pump incorporated into injection pump.

SUPERCHARGER.—Same type as for 4-D 31. Ratio 14.07 : 1.

FUEL.—91 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

LUBRICATION.—Same as for 6-D 02. Pressure feed to supercharger drive.

ACCESSORIES.—Drive for 24-volt 1,600 watt electric generator on left rearside of crankcase. Ratio 2.46 : 1. Tachometer drive on rear of crankcase. Ratio 0.5 : 1. Vacuum pump drive on rear of sump case. Ratio 1.07 : 1. Hydraulic pump drive on rear of crankcase. Ratio 0.5 : 1. Hydraulic airscrew regulator at rear of sump case. Ratio 0.67 : 1.

COOLING.—Same as for 6-D 02. Maximum temperatures (at 2,400 r.p.m.) 255°C. cylinder heads, 160°C. cylinder barrels.

DIMENSIONS.—
- As for 6-D 02, except overall height 720 mm. (28 in.).

WEIGHT DRY.—
- Without accessories 259.5 kg. (570 lb.).

POWER RATING.—
- Take-off output 305 h.p. at 2,400 r.p.m.
- Normal output 260 h.p. at 2,400 r.p.m.
- Max. cruising output 200 h.p. at 2,200 r.p.m.
- Economic cruising output 150 h.p. at 2,000 r.p.m.

CONSUMPTIONS.—
- At take-off 300 gr./h.p./hour.
- At normal output 270 gr./h.p./hour.
- At max. cruising 230 gr./h.p./hour.
- At economical cruising 215 gr./h.p./hour.

THE POTEZ 8-D 30.

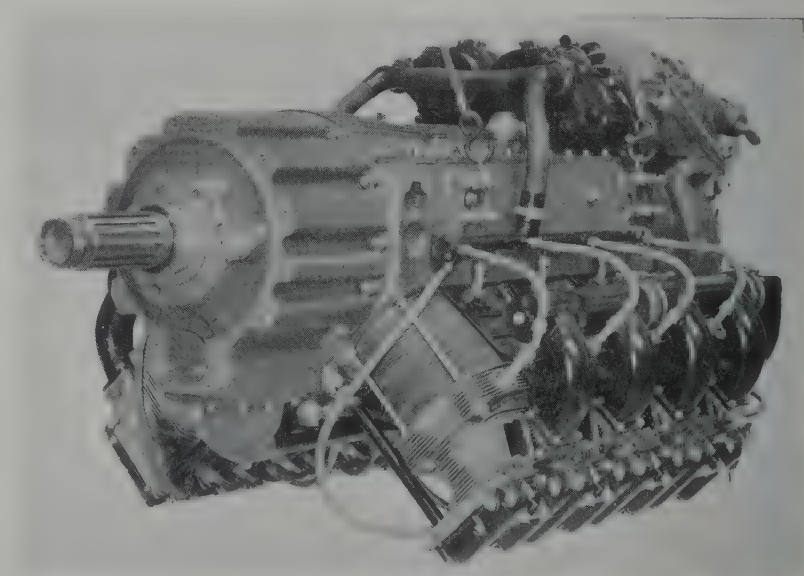
TYPE.—Eight-cylinder 90° inverted Vee air-cooled, geared and supercharged.

CYLINDERS.—Same as for 4-D 01, except swept volume 11.78 litres (719 cub. in.).

PISTONS.—Same as for 4-D 01.

CONNECTING ROD.—Fork and blade type in nitrided nickel-chrome-molybdenum steel, with split big-ends and split steel-backed lead-bronze lead-plated bearings. Assembly by four chrome-nickel steel bolts in fork rod and two in blade rod.

CRANKSHAFT.—Four-throw 90° dynamically-balanced one-piece shaft of nitrided nickel-chrome-molybdenum steel. Five split steel-backed lead-bronze lead-plated bearings. Drive to reduction gear and camshaft from serrated flange bolted to front end of shaft. On rear end is shrunk the flexible torsion shaft to the supercharger drive.



The 500 h.p. Potez 8-D 30 eight-cylinder inverted vee engine.

CRANKCASE.—Aluminium-alloy monobloc casting with cast magnesium-alloy ribbed top cover. Five dual forged bearing caps, three secured by four chrome-nickel steel studs, two by two studs. Chrome-nickel steel through-bolts of three centre bearing caps. Front of the crankcase closed by reduction-gear casing, rear end by supercharger casing and accessory support. Oil sump in rear portion of case and below compressor casing.

VALVE GEAR.—Same as for 4-D 01. Single camshaft in crankcase.

INDUCTION.—Supercharged. One Zenith 95 RGSL automatic carburettor with automatic altitude control and full throttle enrichment. Forced circulation of scavenge oil round intake elbow to blower. Fuel feed by A.M. pump type CM 13.

SUPERCHARGER.—Single-stage single-speed centrifugal supercharger. Ratio 9.83 : 1.

FUEL.—100 Octane minimum. Up to 1.2 cc.'s per litre lead accepted by engine.

IGNITION.—Fully VHF screened. Two R.B. Type P8BA magnetos. Two K.L.G. RFC 5/4R spark-plugs per cylinder. Potez patented automatic spark-advance linked with throttle.

LUBRICATION.—Dry sump type. Two pressure and three scavenge pumps. Oil pressure 35.5-71 lb./sq. in. (2.5-5 kg./cm.^{2}).

REDUCTION GEAR.—Planetary type with seven satelites. Gear ratio 0.657 : 1.

AIRSCREW DRIVE.—Direct, right-hand drive. Airscrew shaft with 16 splines $73.3 \times 67.7 \times 7.4$. Provision for electric or hydraulic variable pitch airscrew.

ACCESSORIES.—Drive for 24-volt 2,500-watt electric generator over supercharger casing. Ratio 2.27 : 1. Tachometer drive on right side of supercharger casing. Ratio 0.5 : 1. Vacuum pump on rear (right) of accessories support. Ratio 1/1. Hydraulic pump on rear (left) of accessories support. Ratio 1 : 1. Electric airscrew regulator. Ratio 0.5 : 1.

STARTING.—Potez 24-volt electric starter mounted in Vee of engine.

MOUNTING.—Four-point flexible mounting, two points forward and two aft of C.G.

COOLING.—Six inter-cylinder deflectors, one rear deflector and one under-scoop. Temperatures as for 6-D 30. This engine can be supplied as a pusher-type with incorporated stepped-up fan and becomes the type 8-D 32.

DIMENSIONS.—
Overall length 1,620 mm. (63.7 in.).
Overall width 795 mm. (31.3 in.).
Overall height 803 mm. (31.6 in.).

WEIGHT DRY.—
Type 8-D 30 (without accessories) 335 kg. (738 lb.).
Type 8-D 32 (without accessories) 355 kg. (780 lb.).
Weight of the accessories 14 kg. (31 lb.).

POWER RATINGS.—
Take-off output 500 h.p. at 2,650 r.p.m.
Normal output at S/L. 410 h.p. at 2,650 r.p.m.
Normal output at 1,900 m. (6,230 ft.) 430 h.p. at 2,650 r.p.m.
Max. cruising output at 2,500 m. (8,200 ft.) 360 h.p. at 2,450 r.p.m.
Econ. cruising output at 3,300 m. (10,825 ft.) 290 h.p. at 2,250 r.p.m.

CONSUMPTIONS.—
At take-off 330 gr./h.p./hour.
At normal output 280 gr./h.p./hour.
At max. cruising 225 gr./h.p./hour.
At economical cruising 215 gr./h.p./hour.

SNECMA.

SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION.

HEAD OFFICE: 150, BOULEVARD HAUSSMANN, PARIS (8e.)

WORKS: PARIS (BOULEVARD KELLERMANN), GENNEVILLIERS (SEINE), BILLANCOURT (SEINE), SURESNES (SEINE) AND VILLAROCHE (SEINE-ET-MARNE).

President and Director-General: Henri Desbruères.

Administrative Director: M. Depallens.

Technical Director (Piston engines and Special Research): Raymond Marchal.

Technical Director (Gas Turbine engines): H. Oestrich.

Director-Controller: Marcel Richer.

Director of External Relations: Gilbert Racine.

Personnel Manager: D. Dugue MacCarthy.

The Société Nationale d'Etude et de Construction de Moteurs d'Aviation. (SNECMA) is the successor to the Société de Moteurs Gnôme-et-Rhône which was nationalised in 1945. In 1946 Renault Aviation was incorporated in SNECMA.

The latest piston engine developed by SNECMA is the 14XH helicopter power-unit.

SNECMA continues to manufacture the Renault 12S and Regnier 4L in-line inverted air-cooled engines, and is building the Hercules 758 and 759 engines under licence from the Bristol Aeroplane Co., Ltd. It also continues to service and repair the Renault 4P and 6Q and Gnôme-Rhône 14N, 14M and 14R engines, which are no longer in production.

SNECMA is now devoting the major part of its activities to the development and series production of gas-turbine engines, for details of which see under "SNECMA" in Part I of this Section.

THE SNECMA 14X HELICOPTÈRE.

This engine is an adaptation of the standard 14X for helicopter installation. It differs from the standard engine in that it can operate with the axis of the engine in any position between the horizontal and vertical planes. The reduction gear has been replaced by a cooling fan and a centrifugal clutch. The blower ratio is 7.30 : 1.

UTILISATIONS AT PROGRESSIVE ROTATIONAL SPEEDS.—
Take-off 810 h.p. at 2,700 r.p.m.
Max. continuous 685 h.p. at 2,650 r.p.m.
Max. cruising 560 h.p. at 2,650 r.p.m.
Recommended cruising 440 h.p. at 2,450 r.p.m.

UTILISATIONS AT CONSTANT ROTATION SPEED (2,500 r.p.m.).
Max rating (1 hour) 700 h.p.
Max. continuous rating 560 h.p.
Recommended cruising 420 h.p.

NOTE.—All above are nett figures, H.P. required for cooling fan having been deducted.

FUEL CONSUMPTION (Grade 100/130).—
At recommended cruising 212 gr./h.p./hr.

THE SNECMA RÉGNIER 4L.00.

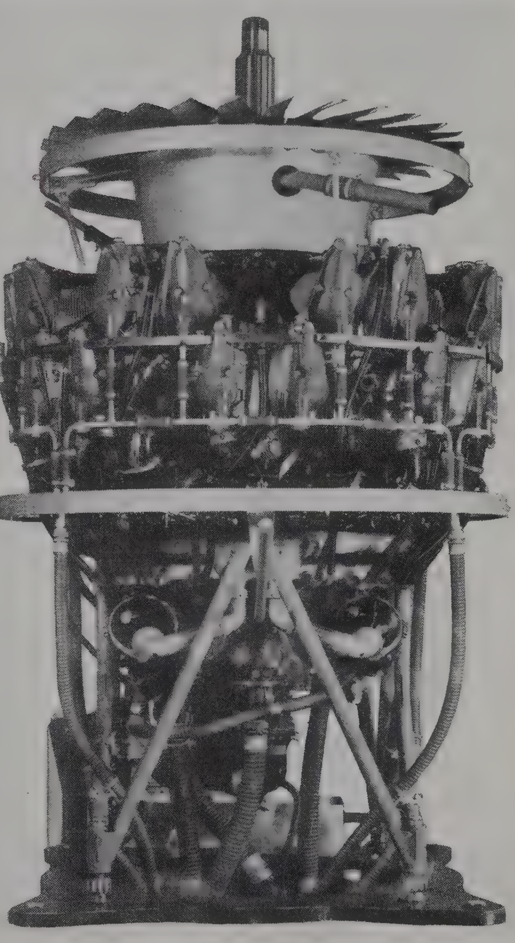
TYPE.—Four-cylinder in-line inverted air-cooled.

CYLINDERS.—Bore 120 mm. (4.72 in.). Stroke 140 mm. (5.51 in.). Capacity 6.3 litres (384.4 cub. in.). Compression ratio 6.2 : 1. Steel barrels machined all over and treated externally with a baked-on varnish to prevent corrosion. Separate Y-alloy heads held on barrels by four long bolts screwed into crankcase with a Metalloplastic joint between head and barrel and a dermatine sealing ring between barrel and crankcase. Valve seats and sparking-plug bushes of bronze-aluminium screwed into head. Rocker boxes integral with heads have Aluminium-alloy covers held in place by quick-release cables.

VALVE GEAR.—One inlet and one exhaust underhead valve per cylinder, each with two springs. Valves operated from camshaft through push rods and adjustable tappets. Engine valve-gear enclosed.

CRANKSHAFT.—Four-throw steel forging on five bearings.

CONNECTING RODS.—I-section duralumin forgings with split steel-backed bronze bearings.



The SNECMA 14X vertically-mounted helicopter engine.

CRANKCASE.—Aluminium-alloy casting carrying the main crankshaft bearings which are held in position by separate caps. All oilways cast internally. All accessory drives and oil pumps enclosed in rear portion of case. Aluminium-alloy cover provided with breather and lifting rings.

IGNITION.—B.G. type 4D4 dual magneto with automatic advance. Two B.G. 4CT2 or Eyquem 612P plugs per cylinder. Shielded ignition harness optional.

CARBURATION.—Zenith type IDCA carburettor on port side of engine. Welded sheet steel manifold with heater muff. Two Guyot type K or O fuel pumps.

LUBRICATION.—Pressure lubrication. Engine-driven gear type pump. All oilways in crankcase casting or drilled in crankshaft webs. Two scavenge pumps, one forward and one aft. Provision for scavenging from crankcase cover when engine inverted.

DIMENSIONS.—
Length (over starter) 1,366 mm. (53.7 in.).
Height 760 mm. (29.8 in.).
Width 500 mm. (19.6 in.).

WEIGHT DRY.—
155 kg. (341 lb.).

PERFORMANCE.—
Take-off output 147 h.p. at 2,340 r.p.m.
Max. continuous output 135 h.p. at 2,280 r.p.m.
Max. cruising output 116 h.p. at 2,160 r.p.m.
Recommended cruising output 106 h.p. at 2,100 r.p.m.

FUEL CONSUMPTIONS.—
Max. continuous 46 litres (10.1 Imp. gallons) per hour.
Max. cruising 35 litres (7.7 Imp. gallons) per hour.
Recommended cruising 32 litres (7 Imp. gallons) per hour.

THE SNECMA RÉGNIER 4L.02.

The 4L.02 is similar to the 4L.00 except for the following differences.

Compression Ratio.—7.25.

Performance.—
Take-off output 170 h.p. at 2,500 r.p.m.
Max. continuous output 170 h.p. at 2,500 r.p.m.
Max. cruising output 119 h.p. at 2,220 r.p.m.
Recommended cruising output 110 h.p. at 2,160 r.p.m.

Fuel Consumptions.—
Take-off 53 litres (11.6 Imp. gallons) per hour.
Max. cruising 34 litres (7.5 Imp. gallons) per hour.
Recommended cruising 31 litres (6.82 Imp. gallons) per hour.

THE SNECMA REGNIER 4L.04.

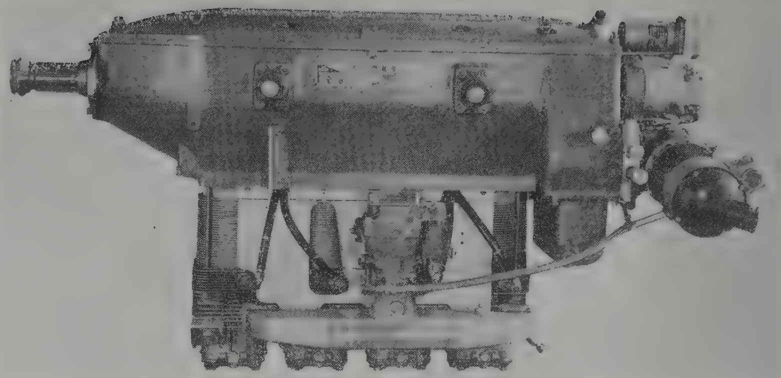
The 4L.04 differs from the 4L.00 in certain re-arrangement of accessories. It is in production for installation in the N.C. 856A military observation aircraft which is being built in series for the French Army.

THE SNECMA REGNIER 4L.06.

This engine is identical to the 4L.02 except for the layout of the accessories. It is being installed in several prototypes.

THE SNECMA REGNIER 4L.08.

The 4L.08 differs from the 41.04 by having a compression ratio of 6.8 : 1. It has a take-off output of 160 h.p. The 4L.08 powers the NC.856H seaplane.



The 170 h.p. SNECMA Régnier 4L.04 four-cylinder inverted engine.

THE SNECMA RENAULT 12S.02.

Type.—Twelve-cylinder inverted 60° Vee air-cooled, geared and supercharged.

Cylinders.—Bore 105 mm. (4.134 in.). Stroke 115 mm. (4.528 in.). Capacity 12 litres (732.3 cub. in.). Compression ratio 6.4 :1. Steel barrels, heat-treated aluminium-alloy heads. Exhaust valve seats of steel, inlet seating, valve guides and spark-plug adaptors of bronze.

Pistons. — Aluminium - alloy. Three compression and one scraper rings.

Connecting Rods. — H-section forgings machined all over. Lead-bronze bearings in steel shells.

Crankshaft. — Six - throw steel forging machined all over. Seven main bearings of lead-bronze in steel shells.

Crankcase.—Aluminium-alloy casting with top cover, closed forward by reduction gear casing and aft by blower casing and rear cover.

Valve Gear.—One inlet and one exhaust valve per cylinder. Entire gear enclosed.

Induction.—Bronzavia type 9 2195 AI carburettor with automatic boost and altitude control and air-warming. Bronzavia type. Bronzavia type 30.900 double fuel pump with by-pass, Bronzavia type 11.900 pressure regulator.

Supercharger.—Single-speed, single-stage centrifugal blower. Ratio 9.35 : 1.

Ignition.—A.B.G. type 12D 12 dual magneto with automatic advance mechanically and hydraulically coupled to throttle. Two B.G. type RB590FR or K.L.G. type RFC 54/R plugs per cylinder. Screened ignition harness.

Controls.—A single throttle control links the induction, ignition and airscrew controls, there being only three positions (55°, 75° and 90°) of the throttle other than idling.

Lubrication.—Dry sump system. One high and one low pressure and two scavenge pumps.

Starter.—Air Equipement type 50920 hand/electric direct starter.

Airscrew Drive.—Epicyclic reduction gear. Ratio 1 : 1.75.

Dimensions.—
Length 1,366 mm. (53.7 in.).
Height 755 mm. (29.7 in.).
Width 500 mm. (19.6 in.).

Weight.—
369 kg. (812 lb.).

Performance.—
Take-off output 580 h.p. at 3,300 r.p.m.
Max. continuous output 439 h.p. at 3,250 r.p.m. at 2,400 m. (7.870 ft.).
Max. cruising output 350 h.p. at 3,100 r.p.m. at 2,600 m. (8,530 ft.).
Recommended cruising output 300 h.p. at 2,850 r.p.m. at 2,800 m. (9,185 ft.).

Fuel Consumptions.—
Max. continuous 188 litres (41.3 Imp. gallons) per hour.
Max. cruising 102 litres (22.4 Imp. gallons) per hour.
Recommended cruising 84 litres (18.4 Imp. gallons) per hour.

SALMSON

SOCIÉTÉ DES MOTEURS SALMSON.

Head Office : 102*bis*, Rue du Point-du-Jour, Billancourt (Seine).

This very old-established firm produced its first engines in 1912 and developed and marketed a range of low and medium-powered radial engines suitable for touring and training aircraft between the wars.

After the last war several of the company's radial engines were revised including the 90 h.p. 5AQ, 135 h.p. 9 NC and the 230 h.p. 9 ABC. Also built was the 8 AS.04, an eight-cylinder inverted vee air-cooled engine derived from the German Argus As 10C.3 which was manufactured in France during the occupation.

Salmson had also developed the 200 h.p. 9 NH nine-cylinder radial engine for helicopters. This engine powered the S.E. 3120 Alouette helicopter which in July, 1953, established six World's records for speed and distance in closed circuit.

Just as "All the World's Aircraft" was closing for press it was announced that the Salmson company would cease all activities as from December 31, 1955. Arrangements were being made with certain firms to ensure that the supply of parts and the maintenance and overhaul of existing Salmson engines would be continued. It was believed that the Salmson factory would be taken over by the Renault Division of SNECMA.

ITALY

ALFA

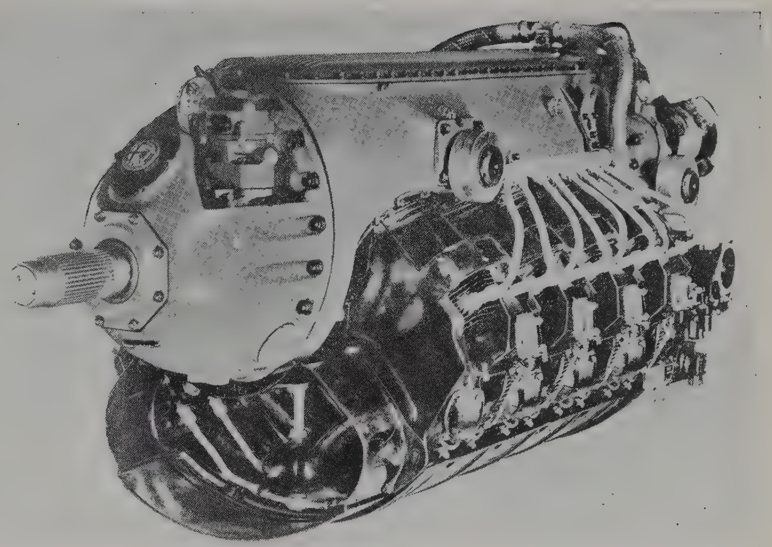
SOCIETÀ per AZIONI ALFA ROMEO.

HEAD OFFICE AND WORKS: VIA M.U. TRAIANO 33, MILAN.

This important company, manufacturers of the well-known Alfa-Romeo automobile, entered the Italian aero-engine industry in 1925 with the acquisition of the Jupiter engine licence from the Bristol Aeroplane Co., Ltd., and the Lynx engine licence from Armstrong Siddeley Motors, Ltd. In 1930 the company produced its first engine of original design, the D2, and in the following year it acquired licences to build the Bristol Mercury and Pegasus engines.

With the experience gained in the development and production of the above-mentioned engines the Alfa company embarked in an extensive programme of original engine design and production.

Current types of Alfa engines are the 225 h.p. Type 115*ter* and the 400 h.p. Type 121.



The 400 h.p. Alfa 121 eight-cylinder inverted Vee engine.

THE ALFA 121.

TYPE.—Eight-cylinder 90° inverted vee air-cooled, geared and supercharged.

CYLINDERS.—Bore 120 mm. (4.72 in.). Stroke 110 mm. (4.33 in.). Capacity 9.952 litres. Compression ratio 6.5 : 1. Nitrided steel barrels machined all over. Aluminium-alloy cylinder heads.

PISTONS.—Duralumin forgings. Three compression rings and one scraper ring above gudgeon-pin, one scraper ring below.

CONNECTING RODS.—Forked rods are steel stampings machined all over. Anti-friction bearings.

CRANKSHAFT.—Four-throw 90° single-piece shaft running on five indium-plated bearings.

CRANKCASE.—Double-wall single-piece Elektron casting.

REDUCTION GEAR.—Spur gear type. Ratio 0.621 : 1.

SUPERCHARGER.—Centrifugal type. Gear ratio 7 : 1.

CARBURATION.—Hobson type DHG5 injection carburettor.

FUEL GRADE.—100/130.

IGNITION.—Twin Marelli or RB C 4/8 magnetos. Shielded ignition harness.

LUBRICATION.—Pressure type. One pressure and three scavenge pumps, one of which for inverted flight. High initial oil pressure device.

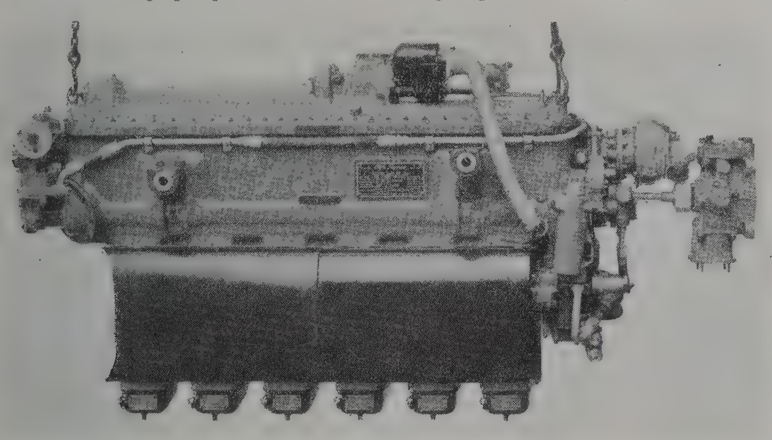
DIMENSIONS.—
Overall width 0.684 m. (26.9 in.).
Overall height 0.700 m. (27.5 in.).
Overall length (including all accessories) 1,780 m. (70 in.).

WEIGHT DRY.—
345 kg. (760 lb.).

PERFORMANCE.—
Take-off output 400 h.p. at 3,000 r.p.m.
Max. continuous output at sea level 330 h.p. at 3,000 r.p.m.
Max. continuous output at 2,000 m. (6,560 ft.) 355 h.p. at 3,000 r.p.m.
Cruising output 250 h.p. at 2,700 r.p.m.

FUEL CONSUMPTIONS.—
At take-off power 290 gr./h.p./hr. (0.63 lb./h.p./hr.).
At max. continuous power 267 gr./h.p./hr. (0.58 lb./h.p./hr.).
At max. continuous power at 2,000 m. (6.600 ft.) 250 gr./h.p./hr. (0.55 lb./h.p./hr.).
At cruising power 2,700 r.p.m., 248 gr./h.p./hr. (0.54 lb./h.p./hr.).

OIL CONSUMPTION.—
Max. 2.5 kg./hr. (5.5 lb./hr.).



The 225 h.p. Alfa 115*ter* engine.

THE ALFA 115*ter*.

TYPE.—Six-cylinder in-line inverted air-cooled. This engine is designed for inverted flying and is equipped with a hydraulic airscrew control.

CYLINDERS.—Bore 118 mm. (4.65 in.) Stroke 140 mm. (5.52 in.). Total swept volume 9.186 litres (560 cub.in.). Compression ratio 6.5/1. All over machined nitrided steel cylinder barrel. Aluminium-alloy cylinder head castings.

PISTONS.—Duralumin forging. Two compression rings and two scraper rings, one above and one below the gudgeon pin.

CONNECTING RODS.—Duralumin forging machined all over.

CRANKSHAFT.—Six-throw single-piece steel forging running in eight bearings.

CRANKCASE.—Elektron casting.

VALVE GEAR.—Two valves per cylinder. Nitrided valve stems. Sodium cooled exhaust valves.

CARBURATION.—Two Mona type A1.55/E3 downdraught carburettors with automatic mixture controls.

FUEL GRADE.—100/130.

IGNITION.—Two screened Marelli type MCR5A magnetos. Two sparking-plugs per cylinder. Screened ignition harness.

LUBRICATION.—Pressure type. One pressure and three scavenge pumps, one for inverted flight.

ACCESSORY DRIVES.—By engine remote driven gearbox through articulated joints.

WEIGHT DRY.—233 kg. (515 lb.).

DIMENSIONS.—
Overall length 1,642 mm. (64.7 in.).
Overall width 498 mm. (19.6 in.).
Overall height 825 mm. (32.5 in.).

PERFORMANCE.—
Max. output at ground level 225 h.p. at 2,400 r.p.m.
Normal output 215 h.p. at 2,250 r.p.m.

FUEL CONSUMPTIONS.—
At take-off power 242 gr./h.p./hr. (0.53 lb./h.p./hr.).
At max. continuous power 235 gr./h.p./hr. (0.515 lb./h.p./hour.

OIL CONSUMPTION.—
Max. 1.3 kg./hr. (2.9 lb./hr.).

THE SOVIET UNION

(The Union of Soviet Socialist Republics)

Russian piston engines, with the exception of a few types of low-powered radial engines, have been mainly developments of foreign designs. The VK Series was based on the French Hispano Suiza 12Y liquid-cooled twelve-cylinder vee; the M.25, 62 and 63 Series were derived from the American Wright R-1820 Cyclone; the M.88 and 89 from the French Gnôme-Rhône 14R; the AM.38 and 42 were based on the German BMW VI twelve-cylinder liquid cooled engine; the ASh. 82 was a development of the American Pratt & Whitney R-1830 Twin-Wasp; the ASh.90 is a copy of the Wright R-3350 engine which was produced to power the Russian copies of the B-29. Most of these engines have been subject to development, but no information, other than that which has appeared in recent issues of "All the World's Aircraft" has become available.

Aero-engine research and development is undertaken by the Ts.A.I.M. (founded in 1930) and all production is handled by State factories. The various engine models are the products of design teams led by responsible engineers. For example, the design of the VK Series is attributed to V. Y. Klimov; the AM Series to Aleksandir Mikulin; and the ASh and M Series to A. D. Shvetsov. For details of the various piston engines already mentioned reference should be made to previous editions of "All the World's Aircraft." Brief details of Russian jet engine development will be found in the Gas Turbine Section of this edition.

SPAIN

E.N.M.A.

EMPRESA NACIONAL DE MOTORES DE AVIACIÓN S.A.

HEAD OFFICE: CALLE DE ANTONIO MAURA 4, MADRID.

WORKS: PASEO DEL GENERAL MOLA, 39, BARCELONA, AND CARRETERA DE SAN ADRIAN S/N, SAN ANDRES, BARCELONA.

President: Ilmo. Sr. D. Modesto Aguilera Morente.

Managing Director: Jose Antonio del Val.

The Empresa Nacional de Motores de Aviación, which took over the Elizalde organization on January 1, 1952, continues to manufacture the Tigre G-IV four-cylinder inverted air-cooled engine, of which there are two models A and B with outputs of 125 and 150 h.p. respectively, and the 500 h.p. Sirio VII-2 seven-cylinder radial.

Under development are the 275 h.p. Alcion seven-cylinder radial, the 90 h.p. Flecha flat-four and the Tigre G-5. The Tigre G-5 is similar to the G-IV-B engine but will be specially equipped for inverted flying and aerobatics.

The E.N.M.A. Tigre in both its 125 and 150 h.p. versions powers the C.A.S.A. built Bücker 131 and various H.M. light aircraft built by AISA. The E.N.M.A. Sirio radial powers the C.A.S.A. 201 and 202 twin-engined commercial monoplanes, and the Hispano HS-42 single-engined trainer.

THE E.N.M.A. SIRIO S-VII-2.

TYPE.—Seven-cylinder radial air-cooled, supercharged.

CYLINDERS.—Bore 150 mm. (5.9 in.). Stroke 145 mm. (5.75 in.). Capacity 17.93 litres (1,090 cub. in.). Compression ratio 6 : 1. Finned steel barrels with cast aluminium head screwed on. One inlet and one sodium-cooled exhaust valve per cylinder.

PISTONS.—Aluminium alloy. Floating gudgeon-pins. Three compression rings and two scraper rings.

CONNECTING RODS.—Master rod and six auxiliary connecting-rods carried on wrist pins. Special bronze little-end bearings.

CRANKSHAFT.—Single-throw shaft in two halves clamped and keyed together. On two roller bearings and one ball bearing for the tail shaft.

CRANKCASE.—Barrel-type single-piece main case of cast Elektron, and a rear case and corresponding cover, which houses the compressor and all accessories.

VALVE GEAR.—Fully-enclosed valve gear comprising push-rods, rocker-arms, etc. with pressure lubrication and scavenge return.

LUBRICATION.—Four pumps in the lower part of the rear crankcase, one pressure and three scavenge pumps. A filter at the outlet of the pressure pump is easily accessible for cleaning. Oil pressure 4 kg./cm.^{2} (56.8 lb./sq. in.).

IGNITION.—Two Scintilla type 2L V7-D4-FE.90 automatic-advance magnetos. Two plugs per cylinder.

CARBURATION.—One double down-draught IRZ Type A-72-D.E carburettor with heater, warm air intake and automatic boost control.

SUPERCHARGER.—Centrifugal type with a gear ratio of 7.85 : 1.

ACCESSORIES.—Fuel pump, compressed air starter and couplings for electric generator, inertia starter, vacuum pump, tachometer and temperature and pressure gauges for fuel, oil, etc.

FUEL GRADE.—87 Octane.

DIMENSIONS.—
Overall diameter 1,120 mm. (44.1 in.).
Length 1,127 mm. (44.4 in.).

WEIGHT.—
327 kg. (719.4 lb.).

PERFORMANCE.—
Max. output 500 h.p. at 2,300 r.p.m.
Normal output 440 h.p. at 2,100 r.p.m. at 2,000 m. (6,560 ft.).
Cruising output (87% power) 382 h.p. at 2,000 r.p.m. at 2,500 m. (8,200 ft.).
Cruising output (75% power) 330 h.p. at 1,850 r.p.m. at 2,500 m. (8,200 ft.).

CONSUMPTIONS.—
Normal output: fuel 280 gr. (.617 lb.) per h.p./hr., oil 12 gr. (.0154 lb.) per h.p./hr.
Cruising: fuel 250 gr. (.551 lb.) per h.p./hr., oil 8 gr. (.0176 lb.) per h.p./hr.

THE E.N.M.A. BETA B-4.

TYPE.—Nine-cylinder radial air-cooled, supercharged.

CYLINDERS.—Bore 155.5 mm. (6.1 in.). Stroke 174.6 mm. (6.8 in.). Capacity 29.85 litres (1,820 cub. in.). Compression ratio 6.4 : 1. Finned steel barrels with cast aluminium-alloy head screwed on. One inlet and one sodium-cooled exhaust valve per cylinder.

CRANKSHAFT.—Single-throw shaft in two pieces clamped and keyed together. Shaft runs on two roller bearings and one ball thrust bearing.

CRANKCASE.—Barrel type of aluminium-alloy.

VALVE GEAR.—Fully-enclosed, with pressure lubrication and scavenge return.

LUBRICATION.—One pressure and one scavenge pump. Oil pressure 3.5-5.5 kg./cm.^{2} (49-77 lb./sq. in.).

IGNITION.—Two FEMSA MAQ-9 magnetos. Two 18 mm. spark-plugs per cylinder.

CARBURATION.—One IRZ four-barrel down-draught carburettor.

SUPERCHARGER.—Centrifugal type. Gear ratio 8.31 : 1.

FUEL GRADE.—87 Octane minimum.

STARTING.—Provision for electric starter or FEMSA hand inertia starter.

DIMENSIONS.—
Diameter 1.365 m. (53.7 in.).
Length 1.170 m. (46 in.).

WEIGHT.—
468 kg. (1,030 lb.).

PERFORMANCE.—
Take-off output 775 h.p. at 2,200 r.p.m.
Normal output 750 h.p. at 2,100 r.p.m. at 2,900 m. (9,510 ft.).
Cruising output 550 h.p. at 1,600 r.p.m. at 3,000 m. (9,840 ft.).

CONSUMPTIONS.—
Fuel (cruising) 250 gr./h.p./hr. (.55 lb./h.p./hr.).
Oil (cruising) 8 gr./h.p./hr. (.0176 lb./h.p./hr.).

THE E.N.M.A. ALCION A-1.

The E.N.M.A. Alcion, which is being built in prototype form, is a seven-cylinder geared and supercharged air-cooled radial. The following are its principal particulars:—

TYPE.—Seven-cylinder radial air-cooled, geared and supercharged.

CYLINDERS.—Bore 110 mm. (4.33 in.). Stroke 110 mm. (4.33 in.). Capacity 7.317 litres (446 cub. in.). Compression ratio 6.5 : 1.

LUBRICATION.—Pressure type. Four pumps. Oil pressure 4 kg./cm.^{2} (56.8 lb./sq. in.).

CARBURATION.—Updraught carburettor.

FUEL GRADE.—100 Octane.

SUPERCHARGER.—Centrifugal. Gear ratio 7.979 : 1.

IGNITION.—Two FEMSA magnetos with automatic advance. Two 18 mm. spark-plugs per cylinder.

AIRSCREW REDUCTION GEAR.—Planetary. Gear ratio 0.66 : 1.

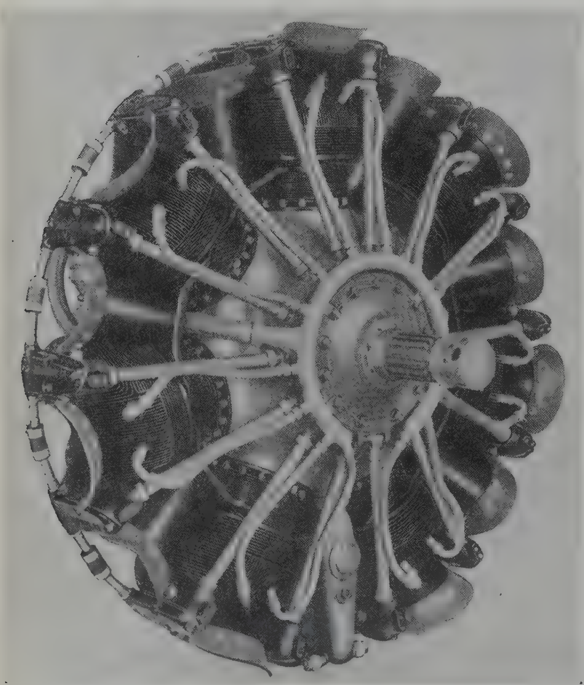
STARTING.—FEMSA electric starter.

DIMENSIONS.—
Diameter 0.850 m. (33.46 in.).
Length 1.166 m. (45.90 in.).

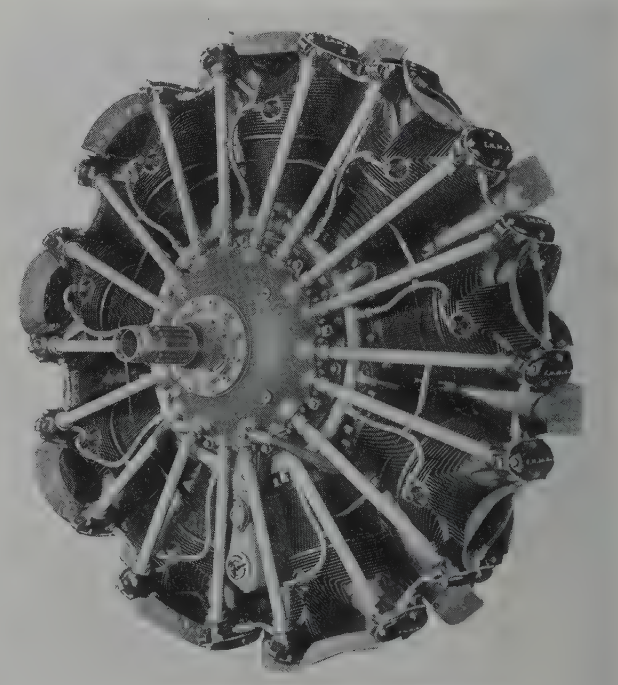
WEIGHT.—
225 kg. (495 lb.).

PERFORMANCE.—
Take-off output 275 h.p. at 3,000 r.p.m.
Normal output 250 h.p. at 2,800 r.p.m. at 1,500 m. (4,920 ft.).
Cruising output 175 h.p. at 2,400 r.p.m. at 2,000 m. (6,560 ft.).

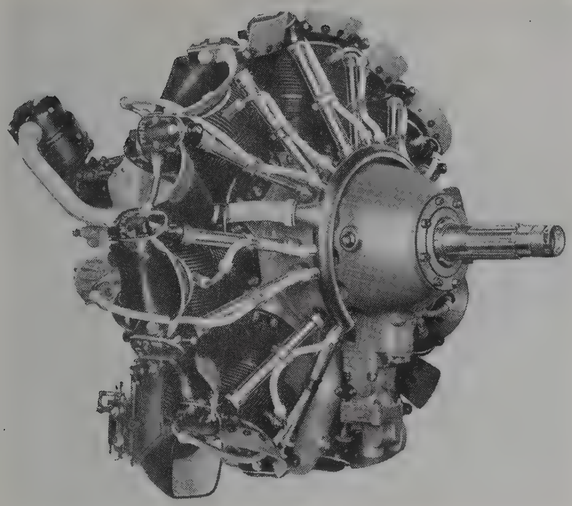
CONSUMPTIONS.—
Fuel (cruising) 210 gr./h.p./hr. (.46 lb./h.p./hr.).
Oil (cruising) 8 gr./h.p./hr. (.0176 lb./h.p./hr.).



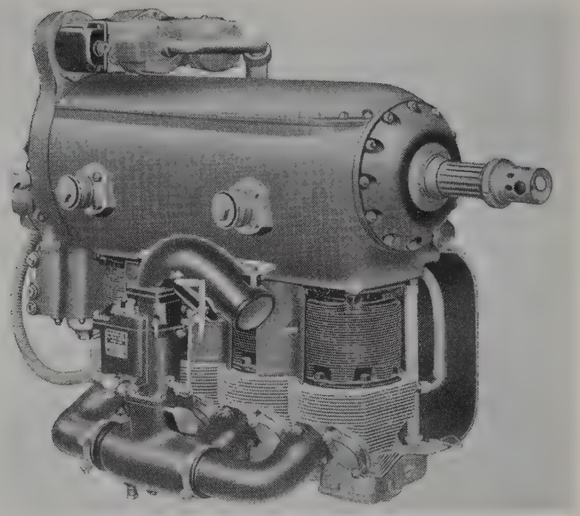
The 500 h.p. E.N.M.A. Sirio S-VII-2 radial engine.



The 775 h.p. E.N.M.A. Beta B-4 radial engine.



The 350 h.p. E.N.M.A. Alcyon A-I radial engine.



The 150 h.p. E.N.M.A. Tigre G-5 four-cylinder inverted engine.

THE E.N.M.A. FLECHA F-IV-1.

The Flecha is an air-cooled flat-four engine which is being built in prototype form. The following are its principal particulars.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore 105 mm. (4.1 in.). Stroke 100 mm. (3.9 in.). Capacity 3.46 litres (211 cub. in.). Compression ratio 7 : 1. Steel cylinders with light alloy heads.

VALVE GEAR.—One inlet and one exhaust valve per cylinder.

CRANKSHAFT.—One-piece steel forging with four throws and running on three bearings.

CRANKCASE.—Aluminium alloy case in two parts, split in vertical plane.

CARBURATION.—"IRZ," Stromberg NA-SE A1 or similar carburettor. S-6000 SS fuel pump.

FUEL GRADE.—87 Octane minimum.

IGNITION.—Two FEMSA magnetos. Two Champion C 27 S or similar spark-plugs per cylinder. Order of firing 1-3-2-4.

LUBRICATION.—Pressure type. Maximum pressure 4 kg./cm.² (56.8 lb./sq. in.) minimum pressure 1.5 kg./cm.² (21.3 lb./sq. in.).

STARTING.—FEMSA electric starter.

ACCESSORIES.—FEMSA 300-watt 24-volt generator.

DIMENSIONS.—
Width 804 mm. (31.64 in.).
Length 809 mm. (31.84 in.).
Height 728 mm. (27.96 in.).

WEIGHT.—
85-90 kg. (187-198 lb.).

PERFORMANCE.—
Nominal output 90 h.p. at 2,500 r.p.m.

CONSUMPTIONS.—
Fuel (max.) 250 gr./h.p./hr. (.551 lb./h.p./hr.).
Oil (cruising) 9 gr./h.p./h.r. (.0198 lb./h.p./hr.).

THE E.N.M.A. TIGRE G-IV-A AND G-IV-B.

TYPE.—Four-cylinder in-line inverted air-cooled.

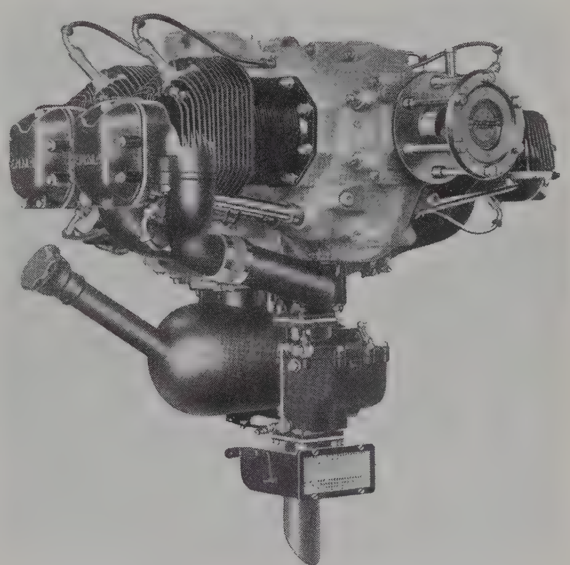
CYLINDERS.—Bore 120 mm. (4.72 in.). Stroke 140 mm. (5.512 in.). Capacity 6.3 litres (386.3 cub. in.). Compression ratio 6 (IVA) or 6.5 (IVB) : 1. Cast Y-alloy cylinder heads. Forged and machined chrome-molybdenum steel barrels. Heads attached to barrels by six studs. Aluminium-bronze inlet valve seats. Austenitic steel exhaust valve seats.

PISTONS.—Aluminium-alloy. Fully-floating gudgeon-pins.

CONNECTING RODS.—Forged aluminium-alloy. Copper - lead big - end bearings, special bronze small-end bearings.

CRANKSHAFT.—Forged and machined chrome - nickel steel four- throw shaft on four copper - lead main bearings and one ball thrust bearing.

CRANKCASE.—Main case of Electron. Aluminium-alloy top cover.



The 90 h.p. E.N.M.A. Flecha F-IV-I flat-four engine.

CARBURATION.—IRZ type A-56 IE (G-IVA) or A-56-IE.B (G-IV B) inverted carburettor.

IGNITION.—Two Femsa magnetos, type MVE.4-109A/B.

LUBRICATION.—Pressure by triple pump driven from rear end of camshaft. Triple oil filter. Oil pressure 2-4 kg./cm.² (28.4-56.8 lb./sq. in.).

FUEL GRADE.—80 Octane.

STARTING.—E.N.M.A. G.3001 GG hand inertia starter. Provision for alternative fitting of electric starter.

DIMENSIONS.—
Length 1,128 mm. (44.33 in.).
Width 400 mm. (15.76 in.).
Height 757 mm. (2.982 in.).

WEIGHT (G-IV A).—
135 kg. (297 lb.).

WEIGHT (G-IV B).—
147 kg. (323 lb.).

PERFORMANCE (G-IV A).—
Normal output 125 h.p. at 2,000 r.p.m.
Cruising output 100 h.p. at 1,850 r.p.m.

PERFORMANCE (G-IV B).—
Normal output 150 h.p. at 2,300 r.p.m.
Cruising output 120 h.p. at 2,140 r.p.m.

CONSUMPTIONS.—
At cruising output (7/10 power).
Fuel 225 gr. (.496 lb.) per h.p./hr.
Oil 8 gr. (.0176 lb.) per h.p./hr.

UNITED STATES OF AMERICA

CONTINENTAL

THE CONTINENTAL MOTORS CORPORATION, AIRCRAFT ENGINE DIVISION.

Head Office: Muskegon, Mich.

Works: Muskegon and Detroit, Mich.

President and General Manager: C. J. Reese.

Vice-President in charge of Sales and Service, Aircraft Division: D. H. Hollowell.

Chief Engineer, Aircraft Division: W. A. Wiseman.

Treasurer: H. W. Vandeven.

In 1928, Continental Motors Corporation, one of the largest automobile engine manufacturers in the World, produced its first aero-engine, a sleeve-valve radial air-cooled incorporating the Argyll (Burt-McCollum) patents, which had been purchased by the Corporation from the British Argyll Company in 1925.

In 1931 the 38 h.p. A40 flat-four was put on the market. This was followed by the A50, A65, A75 and A80 engines.

The current range of Continental light aircraft engines include the A65-8, C85-12, C90-12F, C145-2, E185, E225-4, O-470-A, FSO-470-A (helicopter engine), O-470-B and GSO-526A.

Continental holds a licence to manufacture the French Turbomeca range of gas-turbine engines. In 1954 the company received a production contract from the U.S. Air Force for the J69 turbojet engine (Turbomeca Marboré) which will power the Cessna T-37 twin-jet trainer.

THE CONTINENTAL A65 SERIES.

Type.—Four-cylinder horizontally-opposed air-cooled.

Cylinders.—Bore $3\frac{7}{8}$ in. (98.43 mm.). Stroke $3\frac{5}{8}$ in. (92 mm.). Capacity 171 cub. in. (2.8 litres). Compression ratio 6.3 : 1. Heat-treated cast aluminium-alloy heads screwed and shrunk on to forged-steel barrels. Valve-seat inserts and spark-plug bushings of aluminium-bronze. Bronze valve-guides.

Pistons.—Lo-Ex duralumin-alloy. Trunk type. Full floating gudgeon pin located by end-plugs. Two compression and one scraper rings above gudgeon pins.

Connecting Rods.—Forged steel. Split big-ends carry replaceable thin-shell steel-backed Tri-metal bronze bearings. Bronze bushings pressed into gudgeon pin ends.

Crankshaft.—One-piece, four-throw, chromium-nickel-molybdenum steel forging, drilled for lubrication, runs in three steel-backed Tri-metal bronze bearings, one of which is at middle of shaft.

Crankcase.—Two-piece heat-treated aluminium casting divided at vertical lengthwise plane through crankshaft. Rigid transverse webs carry main bearings and camshaft journals. Rawhide seal prevents oil leakage at airscrew. Four engine-mounting bosses for $\frac{3}{8}$-in. (9.5 mm.) bolts at rear of crankcase.

Valve Gear.—One hardened steel inlet-valve and one heat-resisting austenitic exhaust-valve per cylinder, each operated through rocker-arm, ball-ended push-rod and Wilcox-Rich hydraulic tappet, all sealed to prevent external oil leakage. Cast Preferall camshaft has six hardened cams (intake cams are common to opposing cylinders). Three hardened journals and overhung eccentric at airscrew end to run fuel pump.

Induction System.—Single up-draught Stromberg NA-S3A1 carburettor supplies mixture to cast-aluminium X-manifold with exhaust-heated hot-spot. Steel intake pipes connect manifold to intake ports.

Ignition.—Dual magnetos either Eisemann LA-4, Case 4-CAM-E or Scintilla S4-RN-20.

Lubrication.—Oil at 30 lb./sq. in. (2.11 kg./cm.^{2}) passes through oil tubes in crankshaft to crank-pins and also passes through tappet, push-rod and rocker-arm to rocker-arm bushing and valve-tip. Valve-stem and guide lubricated by splash. Oil returned to crankcase by way of push-rod housings. Pressure filter and relief-valve in crankcase.

Airscrew Drive.—R.H. tractor. Direct. No. 0 S.A.E. taper.

Dimensions, Weights and Performance.—See Table.

THE CONTINENTAL C85 SERIES.

The C85 Series is identical to the earlier C75 Series except that the C85 carburettor has a $1\frac{1}{8}$ in. (29 mm.) venturi as compared with $1\frac{5}{16}$ in. (33.2 mm.) for the C75 and larger main metering jet. The normal rated r.p.m. of the C85 is increased from 2,275 to 2,575 and the cruising r.p.m. from 2,125 to 2,400. The rated output is increased from 75 to 85 h.p.

The Series 8 engine has a tapered crankshaft while the sub-type 8F has a flanged shaft. The Series 12 has the addition of starter and generator drives in the accessory case.

General constructional details are similar to those of the A65 Series. For other details see Table.

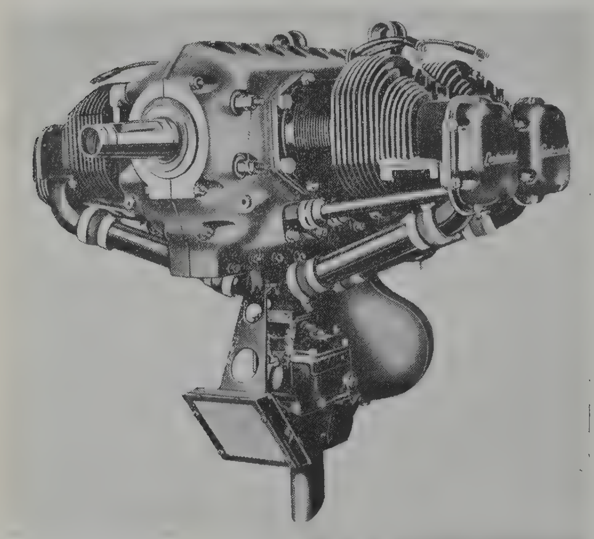
THE CONTINENTAL C90 SERIES.

The C90 Series includes the C90-8F which has a flanged crankshaft but does not have provisions for installing either a starter or generator, and the C90-12F which has a flanged crankshaft and Delco-Remy starter and generator.

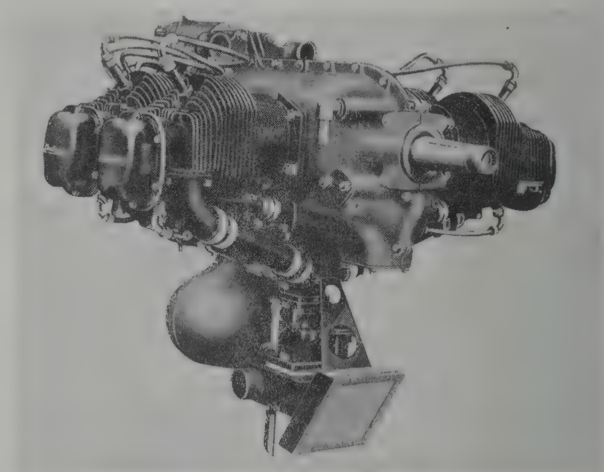
This Series differs from the C85 Series in having cylinders with a slightly larger bore. Otherwise the two engines are constructionally the same. The C90 Series engines have an approved take-off rating of 95 h.p. at 2,625 r.p.m. For other details see Table.

THE CONTINENTAL C145.

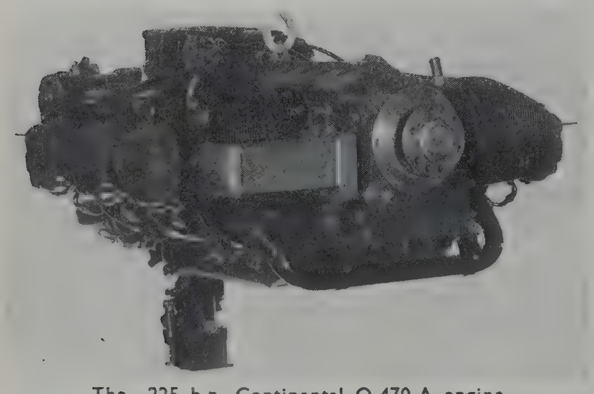
The C145 is a six-cylinder engine which uses the cylinders of the C90 Series.



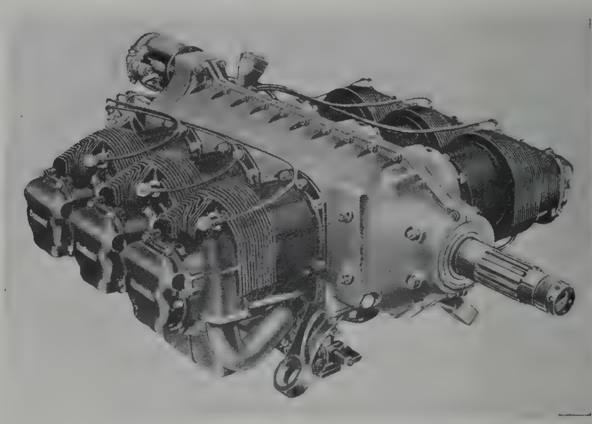
The 65h.p. Continental A65 Series engine.



The 85 h.p. Continental C85 Series engine.



The 225 h.p. Continental O-470-A engine.



The 185 h.p. Continental E185 Series engine.

Equipment includes a Marvel MA-3SPA carburettor, Scintilla S6LN-21 magneto, and Delco-Remy starter and generator. General constructional details are otherwise similar to those of the C90 Series.

THE CONTINENTAL E185 and E225.

These six-cylinder engines were originally developed under Army supervision but have since been refined for civil use. The E185 develops its rated output of 185 h.p. at 2,300 r.p.m., while the E225 has a normal rating of 225 h.p. at 2,650 r.p.m. Low-pressure fuel injection, drive for vacuum or hydraulic pump, Romec vane fuel pump, and wet or dry sump are optional for both engines.

THE CONTINENTAL O-470-A.

Type.—Six-cylinder horizontally-opposed air-cooled.

Cylinders.—Bore 5 in. (127 mm.). Stroke 4 in. (101.6 mm.). Swept volume 471 cub. in. (7.5 litres). Compression ratio 7 : 1. Forged steel barrels with integral cooling fins. Heat-treated cast aluminium alloy heads screwed and shrunk on to barrels.

Pistons.—Aluminium. Three rings, two compression and one oil control. Steel gudgeon pins with circlip retainers.

Connecting Rods.—Forged steel. Trimetal bronze replaceable type big-end bearings, bronze bush little ends.

Crankshaft.—One-piece six-throw chrome-nickel-molybdenum steel forging. Outer surfaces nitrided. Counterweights attached to rear end of shaft. Five bearings of replaceable shell type.

Crankcase.—Two-piece heat-treated aluminium casting divided at vertical lengthwise plane through crankshaft, with integral cast accessory section.

Valve Gear.—Two poppet-type valves per cylinder, one steel inlet and one steel exhaust with stellite seat. Camshaft gear-driven from crankshaft in lower part of crankcase.

Induction.—Marvel MA-4-5 updraught carburettor.

Fuel.—80-87 Octane.

Ignition.—Two Scintilla Type S6RN-25 magnetos on top of accessory section. Two Champion C27-S short-reach spark-plugs per cylinder. Shielded ignition harness.

Lubrication.—Pressure type. Harrison oil-cooler on front of crankcase. Oil filter in crankcase. One impeller type pump. Oil pressure 30-60 lb./sq. in. (2.1-4.2 kg./cm.^{2}).

Airscrew Drive.—R.H. drive. Direct. Special flanged airscrew shaft. Provision for Hartzell constant-speed airscrew.

Accessories.—Delco-Remy generator on accessory section. Drives for vacuum pump and tachometer.

Starting.—Delco-Remy electric starter.

Mounting.—Four mounting points one at each lower corner of crankcase.

Dimensions, Weights and Performance.—See Table.

THE CONTINENTAL FSO-470-A.

The FSO-470-A is the O-470-A engine arranged for helicopter use. It is fitted with fan-cooling. Two belt-driven fans driven off the front end of the crankshaft are enclosed in shrouds, each fan serving one row of three cylinders. For other details see Table.

THE CONTINENTAL O-470-B.

The O-470-B is generally similar to the O-470-A except that inclined valves are used and the carburettor, in this case, a Bendix-Stromberg PDS-5 updraught pressure type, has been moved from underneath the engine to the rear of the engine, thereby making a flat installation possible. The compression ratio has been raised to 8 : 1 and 91/96 Octane fuel is specified. For further details see Table.

THE CONTINENTAL O-470-2.

The O-470-2 is a supercharged version of the O-470. It is fitted with a belt-driven centrifugal blower with a ratio of 10.36 : 1 and a Bendix-Stromberg PSH-5CD horizontal pressure carburettor. In most other respects the engine is similar to the O-470-A.

THE CONTINENTAL GSO-526-A.

The GSO-526-A is a geared and supercharged six-cylinder engine which is basically and constructionally similar to the O-470 Series but has larger cylinders of 5.125 in. (130 mm.) bore and 4.25 in. (108 mm.) stroke. For further details see Table.

THE CONTINENTAL HORIZONTALLY-OPPOSED ENGINES.

Engine Model	No. of Cylinders	Bore and Stroke	Swept Volume	Power Ratings			Comp. Ratio	Dry Weight	Dimensions			Fuel Grade
				Take-off	Normal	Cruise			Length	Width	Height	
A65-8	4	$3\frac{7}{8} \times 3\frac{5}{8}$ in. (98.4 × 92 mm.)	171 cub. in. (2.04 litres)	65 h.p. at 2,350 r.p.m.	65 h.p. at 2,350 r.p.m.	53 h.p. at 2,150 r.p.m.	6.3 : 1	176 lb. (79.9 kg.)	31 in. (787 mm.)	31.5 in. (800 mm.)	—	73 Octane
C85-12F	4	$4\frac{1}{16} \times 3\frac{5}{8}$ in. (103.2 × 92 mm.)	188 cub. in. (3.08 litres)	85 h.p. at 2,575 r.p.m.	85 h.p. at 2,575 r.p.m.	63 h.p. at 2,400 r.p.m.	6.3 : 1	182 lb. (82.6 kg.)	32 in. (813 mm.)	31.6 in. (804 mm.)	—	73 Octane
C90-12F	4	$4\frac{1}{16} \times 3\frac{7}{8}$ in. (103.2 × 98.4 mm.)	201 cub. in. (3.28 litres)	90 h.p. at 2,475 r.p.m.	90 h.p. at 2,475 r.p.m.	68 h.p. at 2,350 r.p.m.	7.0 : 1	186 lb. (84.4 kg.)	32 in. (813 mm.)	31.6 in. (804 mm.)	—	80/87 Octane
C145-2	6	$4\frac{1}{16} \times 3\frac{7}{8}$ in. (103.2 × 98.4 mm.)	301 cub. in. (4.9 litres)	145 h.p. at 2,700 r.p.m.	145 h.p. at 2,700 r.p.m.	108 h.p. at 2,450 r.p.m.	7.0 : 1	265 lb. (120.3 kg.)	41 in. (1,041 mm.)	31.6 in. (804 mm.)	—	80/87 Octane
E185	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	205 h.p. at 2,600 r.p.m.	185 h.p. at 2,300 r.p.m.	130 h.p. at 2,050 r.p.m.	7.0 : 1	344 lb. (156.2 kg.)	46.6 in. (1,183 mm.)	33.4 in. (848 mm.)	—	80/87 Octane
E225-4	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	225 h.p. at 2,650 r.p.m.	225 h.p. at 2,650 r.p.m.	170 h.p. at 2,400 r.p.m.	7.0 : 1	367 lb. (166.6 kg.)	48.4 in. (1,229 mm.)	33.4 in. (848 mm.)	—	80/87 Octane
O-470-A	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	225 h.p. at 2,600 r.p.m.	225 h.p. at 2,600 r.p.m.	175 h.p. at 2,400 r.p.m.	7.0 : 1	381 lb. (173 kg.)	36 in. (915 mm.)	33.3 in. (846 mm.)	27.7 in. (705 mm.)	80/87 Octane
FSO-470-A (Helicopter)	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	260 h.p. at 3,000 r.p.m.	260 h.p. at 3,000 r.p.m.	—	6.0 : 1	531 lb. (240 kg.)	39.6 in. (1,006 mm.)	33.6 in. (855 mm.)	34.8 in. (884 mm.)	91/96 Octane
O-470-B	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	240 h.p. at 2,600 r.p.m.	240 h.p. at 2,600 r.p.m.	—	8.0 : 1	381 lb. (173 kg.)	43.3 in. (1,100 mm.)	33.3 in. (846 mm.)	19.6 in. (498 mm.)	91/96 Octane
O-470-2	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	265 h.p. at 2,600 r.p.m.	250 h.p. at 2,600 r.p.m.	190 h.p. at 2,400 r.p.m.	7.0 : 1	474 lb. (244 kg.)	37.7 in. (960 mm.)	33.6 in. (855 mm.)	30.7 in. (780 mm.)	100/130 Grade
O-470-11	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	213 h.p. at 2,600 r.p.m.	190 h.p. at 2,300 r.p.m.	—	7.0 : 1	395 lb. (180 kg.)	45.2 in. (1,150 mm.)	33.4 in. (850 mm.)	30.1 in. (765 mm.)	80/87 Octane
O-470-13A	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	225 h.p. at 2,600 r.p.m.	225 h.p. at 2,600 r.p.m.	175 h.p. at 2,400 r.p.m.	7.0 : 1	415 lb. (188 kg.)	45.2 in. (1,150 mm.)	33.4 in. (850 mm.)	30.1 in. (765 mm.)	80/87 Octane
GSO-526-A	6	5.125 × 4.25 in. (130 × 108 mm.)	526 cub. in. (8.64 litres)	320 h.p. at 3,000 r.p.m.	290 h.p. at 3,000 r.p.m.	220 h.p. at 2,700 r.p.m.	6.0 : 1	540 lb. (245 kg.)	52.8 in. (1,340 mm.)	36 in. (915 mm.)	23.9 in. (610 mm.)	91/96 Octane

FRANKLIN

AIRCOOLED MOTORS, INC.

Head Office and Works: Syracuse 8, N.Y.

President and General Manager: C. F. B. Roth.

Sales Manager: C. H. Bennum.

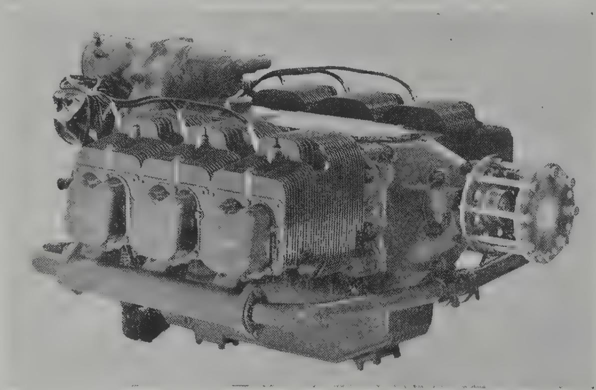
Service Manager: W. I. Marble.

Chief Engineer: G. T. Bynum.

Aircooled Motors, Inc. produced the first of its very successful series of light horizontally-opposed air-cooled engines in 1938. Up to the outbreak of war it had placed on the market engines of four and six cylinders ranging in output from 65 to 150 h.p.

Aircooled Motors, Inc. has been very active in the development of self-cooled aircraft engines both for helicopter and conventional installations. A cooling-fan is incorporated on some models as an integral part of the engine and together with air housings will permit a totally-submerged engine installation in either the vertical or horizontal position.

The current series of Franklin engines comprises a number of six-cylinder models covering a range of from 150 to 300 h.p.



The 130-165 h.p. Franklin 335 engine.

FRANKLIN AIRCOOLED ENGINES.

Type.—Six-cylinder, horizontally-opposed direct-drive air-cooled.

Cylinders.—One-piece aluminium-alloy with removable iron liner. Attached to crankcase by integral hold-down flange and studs and nuts.

Pistons.—Trunk-type, aluminium-alloy permanent-mould. Two compression and one oil ring per piston. Fully-floating piston-pins.

Crankshaft.—One-piece six-throw steel forging with SAE standard airscrew shaft flange. Main and connecting rod bearings steel-backed and copper-lead faced.

Crankcase.—Aluminium-alloy in two halves split vertically. Detachable wet oil-sump underneath.

Valve Gear.—One overhead inlet and overhead exhaust valve per cylinder actuated by push-rods through rocker-arms with adjustable tappets. Wilcox-Rich hydraulic valve lifters provide zero-clearance regardless of engine temperature. Valve-gear totally enclosed and internally lubricated.

Carburation.—Marvel-Schebler float-type carburettor with altitude-control and idle cut-off, or Bendix-Stromberg pressure-type non-icing carburettor. Not optional.

Remarks.—Some models are entirely self-cooled by means of an integral axial-flow fan directly connected to the crankshaft. Air housings are provided which make these engines suitable for submerged installations.

Weights (with starter, generator and oil-cooler).—
320 lb. (145.3 kg.).

Performance.—
Rated output: 150 h.p. at 2,600 r.p.m. (6A4-150-B3), 165 h.p. at 2,800 r.p.m. (6A4-165-B3), 185 h.p. at 3,100 r.p.m. (6AG4-185-B12 with .632 : 1 reduction gear).

THE FRANKLIN 335.

Type.—Six-cylinder horizontally-opposed air-cooled.

Cylinders.—Bore 4½ in. (114.3 mm.). Stroke 3½ in. (88.9 mm.). Capacity 335 cub. in. (5.5 litres). Compression ratio 7.0 : 1.

Fuel Grade.—80 Octane.

Accessories.—Dual magnetos, float-type carburettor, 12-volt starter-generator, oil cooler. Fuel pump optional.

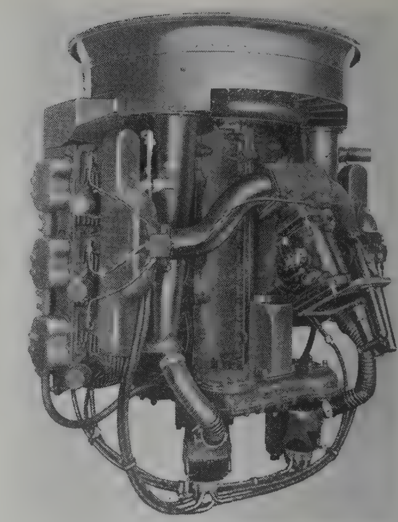
THE FRANKLIN 335 VERTICAL

Type.—Six-cylinder horizontally-opposed air-cooled. Engine operates in vertical position and is designed especially for a helicopter installation.

Accessories.—Dual magnetos, float or pressure-type carburettor, 12-volt starter, generator, fuel-pump, oil-cooler.

Weight.—
310 lb. (140.7 kg.).

Performance.—
Nett rated output: 178 h.p. at 3,000 r.p.m. (6V4-178-B32 and B33) without fan, or 200 h.p. at 3,100 r.p.m. (6V4-200-C32 and C33) using 90/91 octane fuel.



The 300 h.p Franklin 425 helicopter engine.

THE FRANKLIN 425 VERTICAL.

Type.—Six-cylinder horizontally-opposed air-cooled. Designed specially for helicopter installation and operates in vertical position. Equipped with axial-flow cooling fan and air housing. The 6V6-300-D16FT is fitted with supercharger.

Cylinders.—Bore 4¾ in. (120.6 mm.). Stroke 4 in. (101.6 mm.). Displacement 425 cub. in. (6.8 litres). Compression ratio 7.5 : 1.

Fuel Grade.—80 Octane (6V6-245-B16F) or 100/130 Grade (6V6-300-D16FT).

Dimensions.—
Width overall 33 9/32 in. (845 mm.).
Height overall 38 in. (965 mm.).
Length overall 39 7/32 in. (996 mm.).

Weight Dry.—
352 lb. (160 kg.) (6V6-245-B16F), 397 lb. (180 kg.) (6V6-300-D16FT) with cooling system, ignition system, carburettor, priming system and accessory drive covers.

Performance (6V6-245-B16F).—
Max. power for take-off 245 h.p. at 3,275 r.p.m.

Performance (6V6-300-D16FT commercial).—
Max. power for take-off 300 h.p. at 3,275 r.p.m.
Normal power 285 h.p. at 3,275 r.p.m.

Consumptions (6V6-245-B16F).—
Fuel (cruising) .52 lb. (.236 kg.) per h.p./hr.
Oil .02 lb. (.009 kg.) per h.p./hr.

Consumptions (6V6-300-D16FT).—
Fuel 0.43 lb. (.195 kg.) per h.p./hr.
Oil 0.20 lb .(.009 kg.) per h.p./h.r.

JACOBS

THE JACOBS AIRCRAFT ENGINE COMPANY.

Head Office and Works: Pottstown, Pennsylvania.

President: R. Eberstadt.

Vice-President, Treasurer and General Manager: Floyd J. Sisto.

Vice-President, Manufacturing and Engineering: Cleemann Withers.

Vice-President in charge of Public Relations: E. F. Gillespie.

Chief Engineer—Aero-Engines: G. F. Pearson.

Secretary: Robert F. Danley.

The Jacobs Aircraft Engine Company has been manufacturing aircraft engines since 1929.

The current production engine series is the R-755, which includes the R-755A, R-755B and R-755E. The R-755A develops 300 h.p. at a power/weight ratio of only 1.68 lb./h.p. (0.72 kg./h.p.). The R-755B has a lower rating and in its B2 form can be fitted with a constant-speed airscrew. The R-755E is a geared version of the R-755A. All engines now incorporate porous chrome-plated cylinder bores and a new type piston and ring assembly giving reduced oil consumption and vastly increased service life.

THE JACOBS R-755A.

Type.—Seven-cylinder air-cooled radial.

Cylinders.—Bore 5.25 in. (133 mm.) Stroke 5 in. (127 mm.). Capacity 757 cub. in. (12.4 litres). Compression ratio 6 : 1. Barrels machined from steel forging with porous chrome-plated bores. Aluminium-alloy heads screwed and shrunk on. Aluminium-bronze valve-seats shrunk into heads.

Pistons.—Forged aluminium-alloy. Two wedge type compression rings, one ventilated oil control ring above gudgeon pin and one scraper ring below. Fully-floating, nitrided gudgeon pins.

Connecting Rods.—One-piece steel master-rod with bronze little end bearing and steel-backed lead-bronze big-end bearing. Forged aluminium-alloy link-rods, the aluminium bearing directly on nitrided steel gudgeon pins and knuckle pins.

Crankshaft.—Two-piece clamp type, made from chrome-nickel molybdenum steel forgings. Two main roller bearings, one ball thrust bearing and one ball rear bearing.

Crankcase.—Built up of five parts. First, magnesium-alloy front case carrying the thrust ball-bearing and valve-operating gear; second, front half of main crankcase, aluminium-alloy casting which supports the front crankshaft roller-bearing; third, gear half of main crankcase, magnesium-alloy casting, which supports the rear crankshaft roller-bearing and incorporates a ring-type intake manifold; fourth, magnesium-alloy rear plate, which carries additional crankshaft, ball-bearing and supports accessory drives; magnesium-alloy rear case, which carries accessories.

Valve Gear.—Two valves per cylinder. The whole valve gear (cam, drive gears, tappets and push-rods) is in the nose section. All moving parts enclosed. Tulip-type inlet valves, and sodium-cooled exhaust valves. Two springs per valve.

Carburation.—Single Stromberg NA-R7A carburettor.

Ignition.—One Scintilla magneto and one Scintilla battery distributor, incorporating automatic spark advance.

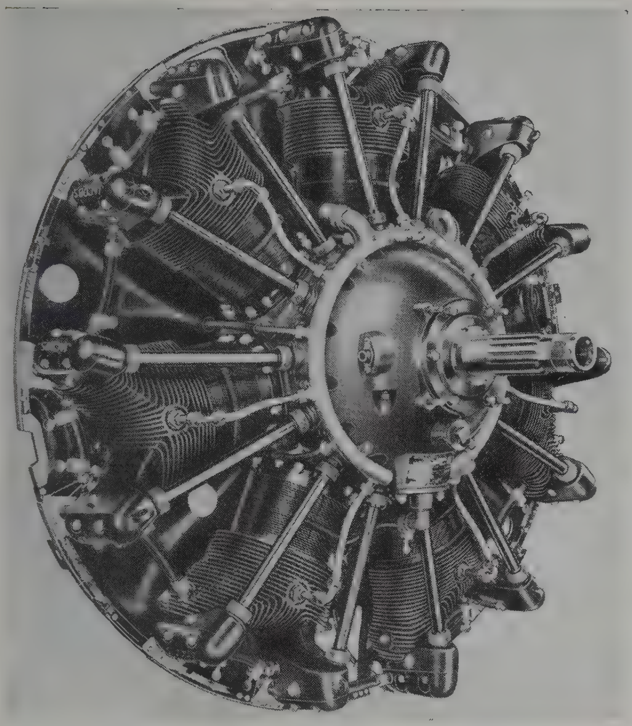
Lubrication.—One gear-type pump comprising two pressure sections and one scavenging section. Dry sump. Pressure to all plain bearings. A take-off to operate an adjustable-pitch or constant-speed airscrew can be incorporated. Automatic valve lubrication is standard equipment.

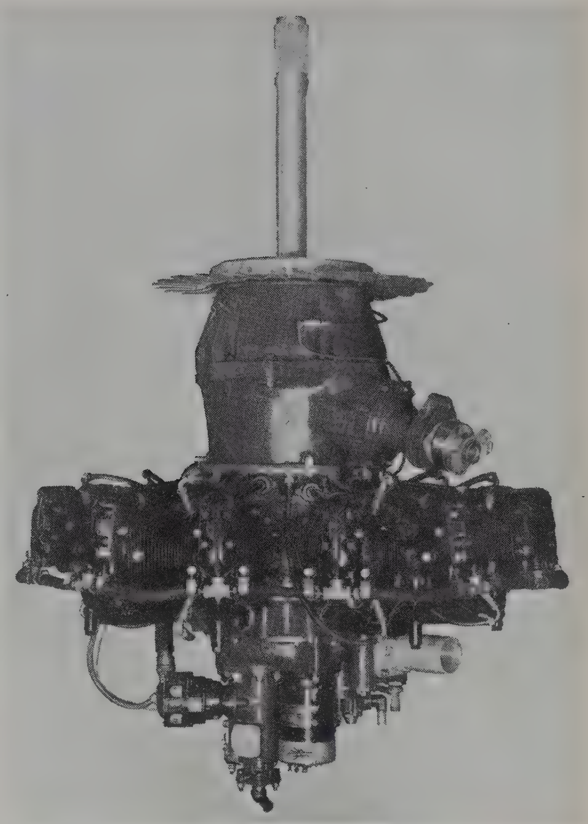
Fuel.—80 octane minimum.

Airscrew Drive.—R.H. tractor. Direct. No. 20 SAE spline.

Accessory Drives.—Drives for airscrew governor, vacuum pump, fuel pump and hydraulic pump.

Starting.—Eclipse E.80 starter.





Above, the 300 h.p. Jacobs R-755A engine and, on the right, the 370 h.p. Jacobs R-755EH helicopter power and transmission unit.

Dimensions.—
Diameter 44 in. (1,118 mm.).
Length (to rear of mounting plate) 39½ in. (1,006 mm.).
Overall length $40\frac{7}{32}$ in. (1,020 mm.).
Weight.—
505 lb. (229 kg.).
Performance.—
Rated output 300 h.p. at 2,200 r.p.m.

THE JACOBS R-755B.

This engine is basically similar to the R-755A in all particulars except performance. Two versions are available; the R-755B1 which drives a fixed-pitch airscrew, and the R-755B2 which has provision for the installation of a hydraulically-operated constant-speed airscrew. A two-position controllable airscrew can be fitted when a control valve is used.

Weight Dry (R-755B1).—
505 lb. (229 kg.).
Weight Dry (R-755B2).—
511 lb. (232 kg.).
Performance.—
Take-off and rated power 275 h.p. at 2,200 r.p.m.

THE JACOBS R-755E.

The R-755E engine is a geared version of the R-755A engine and has the same displacement but a higher rating. Stressed parts are strengthened. Construction is similar to the R-755A except where stated.

Type.—Seven-cylinder air-cooled radial, geared.
Compression Ratio.—6.5 : 1.
Crankshaft.—Clamp type, made of chrome nickel molybdenum steel forgings with two puck-type torsional vibration dampers.
Crankcase.—Built up of five parts. First; the front case, a magnesium casting carrying the reduction gears, propeller shaft, and valve tappet assemblies; second, the front main crankcase, an aluminium casting which supports the front main bearing; third, the rear main crankcase, an aluminium casting incorporating the ring-type manifold and the rear main bearing; fourth, magnesium-alloy rear plate which carries an additional crankshaft ball-bearing and supports accessory drives; and fifth, the magnesium-alloy rear case which carries the accessories.
Fuel.—91 Octane.
Airscrew Drive.—Airscrew is driven at .6491 times crankshaft speed through planetary reduction gear. S.A.E. No. 30 airscrew spline.
Dimensions.—
Diameter 44 in. (1,118 mm.).
Length to rear of mounting plate 29.22 in. (742 mm.).
Overall length 42.3 in. (1,074 mm.).
Weight.—
600 lb. (272 kg.).
Performance.—
Take-off and rated power, 350 h.p. at 2,500 r.p.m.

THE JACOBS R-755EH.

The R-755EH is the helicopter power and transmission unit which has been developed to serve as the power-unit for the Jacobs Type 104 Gyrodyne. The engine is similar to the R-755E but is mounted with the crankshaft in the vertical position and has a special front case which encloses the clutch and rotor transmission systems. The engine uses the same ignition system as the E, but has a Simmonds fuel injector instead of a carburetter.

Weight.—
760 lb. (344 kg.).
Performance.—
Take-off rating 350 h.p. at 2,500 r.p.m. at S/L.
Normal rating 350 h.p. at 2,500 r.p.m. at S/L.
Cruise rating 275 h.p. 2,300 r.p.m. at S/L.

LYCOMING

THE LYCOMING DIVISION OF THE AVCO MANUFACTURING CORPORATION.

Head Office: 550, South Main Street, Stratford, Connecticut.

Works: Stratford, Conn., and Williamsport, Pennsylvania.

President and General Manager: S. B. Withington.

Vice-President, Engineering: Arthur Nutt.

Vice-President, Turbine Engineering: Dr. Anselm Franz.

Vice-President, Industrial Relations: James E. Mitchell.

Vice-President, Manager, Stratford Plant: Donald F. Turner.

Vice-President, Manager, Williamsport Plant: Floyd J. Bird.

Controller: C. J. Mason.

The Lycoming Division is the manufacturing division of the AVCO Manufacturing Corporation.

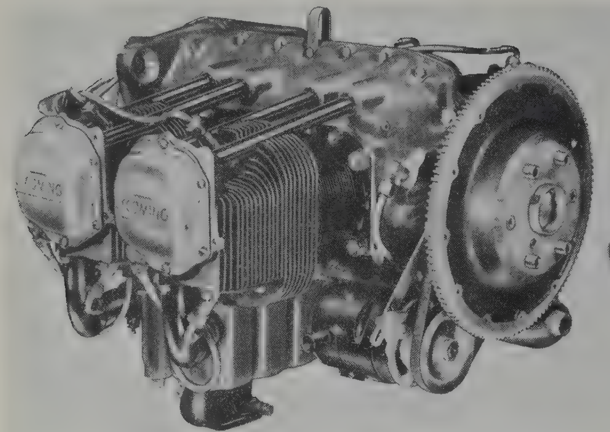
The Division is licenced by the Wright Aeronautical Division of the Curtiss-Wright Corporation to manufacture the R-1300 and R-1820 Series seven and nine-cylinder radial air-cooled engines in nine models at its Stratford plant.

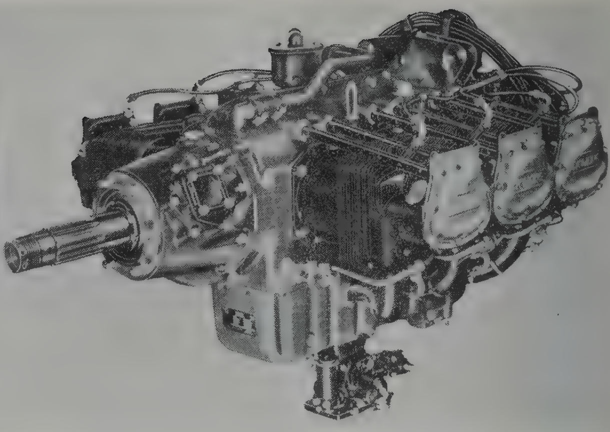
It also manufacturers at its Williamsport plant the Lycoming series of horizontally-opposed air-cooled engines in six basic models, three four-cylinder, two six-cylinder and one eight-cylinder.

THE LYCOMING O-235 and O-290 SERIES.

There are two current O-290 Series engines, the O-290-D2 and O-290-D2A. These two engines are the same except that the O-290-D2A incorporates provision for a single-acting hydraulically-controlled airscrew and an AN airscrew governor drive.

Type.—Four-cylinder horizontally-opposed air-cooled.
Cylinders.—Bore O-235-C 4⅜ in. (111 mm.). O-290-D 4⅞ in. (123.7 mm.). Stroke (both) 3⅞ in. (98.4 mm.). Aluminium-alloy head screwed and shrunk onto steel barrel. Cylinder assemblies attached to crankcase by studs and nuts.
Pistons.—Machined from aluminium-alloy forgings O-235 piston has four rings, two compression, an oil regulator and an oil scraper. O-290 has three rings, two compression and one oil regulating. Fully-floating gudgeon-pins with aluminium-alloy retaining plugs.
Connecting Rods.—Forged steel. Copper-lead steel-backed precision type bearings. Bronze bushed little ends.
Crankshaft.—One-piece forged chrome nickel molybdenum steel four-throw shaft on four nitrided bearings.
Crankcase.—Aluminium-alloy casting split on vertical centre-line. Four precision copper-lead steel-backed main bearings.
Valve Gear.—Two valves per cylinder. Inlet valves of Silchrome No. 1, exhaust valves of AMS 5682 with Stellite-faced heads. Value seats of AMS 5700 shrunk into head.
Induction.—Marvel-Schebler MA-3A carburetter with manual altitude control and idle cut-off. Centre zone distribution chamber in oil sump.





On the left, the 150 h.p. Lycoming O-320 and, on the right, the 260 h.p. Lycoming GO-435-B engines.

IGNITION.—Two Bendix Scintilla S4LN magnetos, one driven through an impulse coupling.

LUBRICATION.—Full pressure wet sump type.

ACCESSORIES.—Starter, generator and tachometer drive. Starter is a Delco-Remy 12-volt automotive type located at front and cranks engine through a Bendix drive which engages with a gear integral with rear airscrew flange. Delco-Remy 12-volt automotive generator also at front of engine and driven by belt and pulley. Optional drives for fuel pump and vacuum pump can be supplied. Pads for these optional drives mounted on rear of engine.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE LYCOMING O-320.

The O-320 is basically the same as the O-290-D2A except for an increase in cylinder bore to $5\frac{1}{8}$ in. (130 mm.) with a corresponding increase in swept volume to 319.8 cub. in. (5.2 litres). For other details see Table.

THE LYCOMING O-435 SERIES.

The O-435 Series includes direct-drive, geared and geared and supercharged models, details of which will be found in the Table. The O-435-KI is a direct-drive engine for horizontal helicopter installation while the O-435-V is a helicopter engine for vertical installation. The GSO-435-B2 is the same as the GSO-435-B except for an AN airscrew governor drive mounted on the left side of airscrew reduction gear housing. This increases the length of the engine by 0.47 in. and the engine weight to 496 lb. (225.1 kg.).

TYPE. — Six-cylinder horizontally-opposed air-cooled incorporating the major components of O-290.

CYLINDERS.—Bore $4\frac{7}{8}$ in. (123.7 mm.). Stroke $3\frac{7}{8}$ in. (98.4 mm.).

PISTONS.—Aluminium-alloy pistons with two compression and two oil control rings.

CONNECTING RODS.—H-section steel forgings with replaceable bearing inserts in big-ends and split bronze bushings in little ends.

CRANKSHAFT. — Machined from chrome nickel molybdenum steel forging. All bearing surfaces nitrided.

CRANKCASE. — Aluminium-alloy casting split on the vertical centre-line. Additional ball-thrust bearing at forward end of case.

INDUCTION. — Marvel-Schebler MA-4-5 single barrel carburettor attached to bottom of oil sump casting. The distributing zone is submerged in oil. Separate induction pipes lead to inlet valves.

IGNITION.—Two Bendix-Scintilla magnetos driven by spur gears from the timing gear.

LUBRICATION.—Full pressure type, including valve mechanism. Crankshaft equipped with centrifugal sludge-removers. Pistons, gudgeon pins and accessory drive gears lubricated by splash.

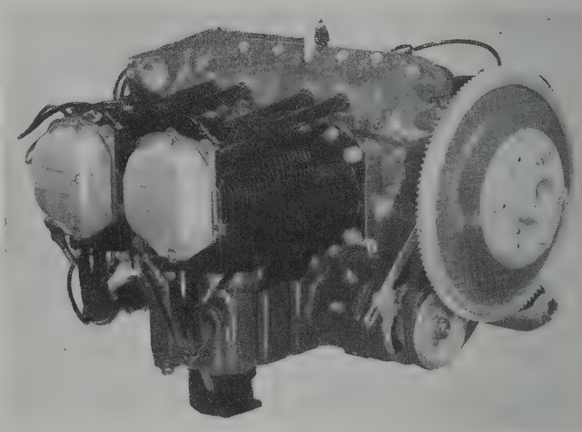
ACCESSORY HOUSING.—Aluminium-alloy casting bolted to rear of crankcase and top rear of oil sump. Houses oil pump and geared accessory drives, and provides mounting for starter and generator, fuel pump, tachometer drive and magnetos. Vacuum pump drive optional equipment.

STARTING.—Delco-Remy 12-volt automotive type starter. Starter torque applied to crankshaft gear through Bendix-type starter drive.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE LYCOMING O-480 SERIES.

The O-480 Series is basically the same as the O-435 except for an increase in cylinder bore to $5\frac{1}{8}$ in. (130 mm.). The GSO-480-B has a supercharger drive ratio of 11.27 : 1, which provides rated power to an altitude of 13,000 ft. (3,965 m.). For other details see Table.



The Lycoming O-235 and O-290 Series engine.

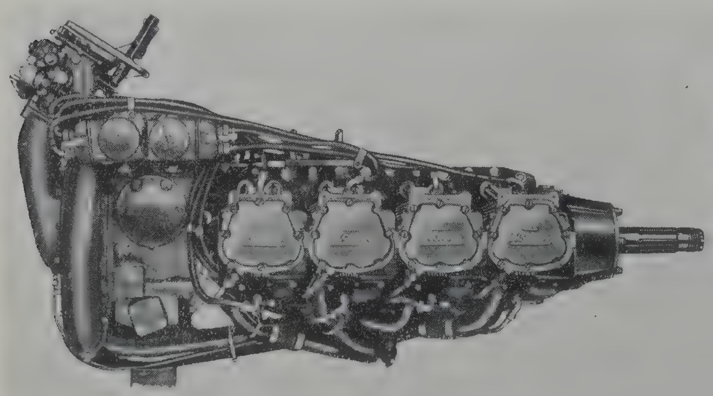
THE LYCOMING GSO-580 SERIES.

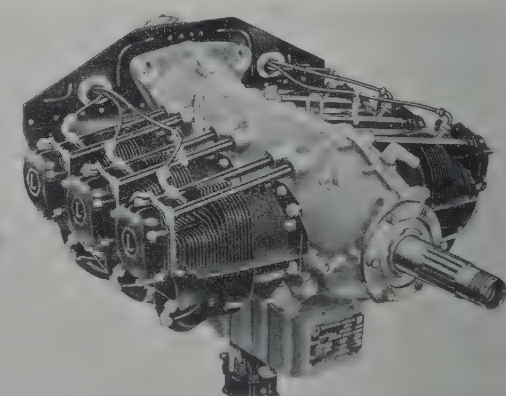
Current GSO-580 Series engines are the GSO-580-C and GSO-580-D (Military designation XO-580-1). Details of both these engines will be found in the Table. The GSO-580-C is identical to the GSO-580-D except that it is rated on 91/96 Grade fuel at 375 h.p. at 3,300 r.p.m. for take-off and 320 h.p. at 3,000 r.p.m. maximum continuous.

Model SO-580-D is the same as the GSO-580-D less the reduction gear, for horizontal helicopter installation. The SO-580-V is the same but suitable for vertical installation.

TYPE.—Eight-cylinder horizontally-opposed air-cooled, geared and supercharged.

CYLINDERS.—Bore $4\frac{7}{8}$ in. (123.7 mm.). Stroke $3\frac{7}{8}$ in. (98.4 mm.). Displacement 578 cub. in. (10.4 litres). Compression ratio 7.30 :1.





On the left the 350 h.p. Lycoming GSO-580-D and, on the right, the 190 h.p. Lycoming O-435-A engines.

Aluminium-alloy heads, with 50% increase in fin area over previous Lycoming head design, screwed and shrunk onto steel barrels. Cylinder assemblies attached to crankcase by studs and nuts.

PISTONS.—Forged aluminium pistons with three rings above gudgeon pin and one below. Top ring is a compression ring, wedge type, chrome plated. Second ring, also compression type, is cast iron wedge type. Third ring is an oil regulating ring. Fourth ring is an oil scraper below fully-floating gudgeon pin.

CONNECTING RODS.—H-section alloy steel. Fitted with replaceable inserts at crank-pin journals and bronze bushings at piston-pin ends.

CRANKCASE.—Two machined aluminium-alloy castings joined on vertical centre-line by through bolts and studs.

CRANKSHAFT.—Eight-throw chrome nickel molybdenum shaft on five main bearings. Fitted with four pairs of dynamic dampers tuned to crankshaft torsional period to eliminate fourth order torsional vibration.

REDUCTION GEAR.—Planetory type, 77 : 120 ratio.

AIRSCREW GOVERNOR DRIVE.—AND-20010 airscrew governor drive on reduction-gear housing, permitting use of a hydraulically-controlled constant-speed airscrew.

CARBURATION.—Pressure-type Bendix carburettor Model PS-9BDE with altitude control and solenoid primer.

SUPERCHARGER.—Centrifugal type supercharger with a single outlet directly connected to central distributing zone with four Y-type intake pipes connecting distributing zone to cylinders. Ratio 7.9 : 1.

IGNITION.—Two Scintilla S4RN-21 magnetos.

LUBRICATION.—Full-pressure dry sump.

ACCESSORIES.—Pads for mounting starter, generator, fuel pump, hydraulic pump, vacuum pump and tachometer. All accessories are side-mounted for ease of servicing.

DIMENSIONS. WEIGHTS AND PERFORMANCE.—See Table.

THE LYCOMING WRIGHT R-1300 CYCLONE 7.

Lycoming has assumed the responsibility for the manufacture, under a licence from Wright Aeronautical, of the R-1300 Cyclone 7 seven-cylinder radial air-cooled engine. A full structural description of this engine has appeared in previous editions of "All the World's Aircraft" under "Wright."

THE LYCOMING WRIGHT R-1820 CYCLONE 9.

Lycoming is also responsible for the manufacture of the R-1820 Cyclone 9 nine-cylinder radial air-cooled engine, under a licence from the Wright Aeronautical Division, in the following seven versions:—

R-1820-76A. Reduction gear ratio 0.666 : 1.

LYCOMING HORIZONTALLY-OPPOSED ENGINES.

Engine Model	No. of Cylinders	Rated output at Sea level	Capacity	Compression Ratio	Octane No.	Weight Dry	Overall Length	Overall Width	Overall Height	Gear Ratio
O-235-C1	4	108 h.p. at 2,600 r.p.m. (T.O. 115 h.p. at 2,800 r.p.m.)	233 cub. in. (3.85 litres)	6.75 : 1	80/87	235 lb. (106.6 kg.)	29.56 in. (751 m/m.)	32.00 in. (812 m/m.)	22.53 in. (570 m/m.)	Direct
O-290-D2	4	135 h.p. at 2,600 r.p.m. (T.O. 140 h.p. at 2,800 r.p.m.)	289 cub. in. (3.85 litres)	7.5 : 1	80/87	260 lb. (118 kg.)	30.09 in. (764 m/m.)	32.24 in. (819 m/m.)	22.81 in. (579 m/m.)	Direct
O-320	4	150 h.p. at 2,700 r.p.m.	319.8 cub. in. (5.2 litres)	7.0 : 1	80/87	268 lb. (121.6 kg.)	30.09 in. (764 m/m.)	32.24 in. (819 m/m.)	24.68 in. (627 m/m.)	Direct
O-435-A	6	190 h.p. at 2,550 r.p.m.	434 cub. in. (7.1 litres)	6.5 : 1	80/87	392 lb. (177.9 kg.)	38.10 in. (967 m/m.)	32.24 in. (817 m/m.)	29.59 in. (751 m/m.)	Direct
O-435-H	6	195 h.p. at 2,600 r.p.m. (T.O. 200 h.p. at 2,800 r.p.m.)	434 cub. in. (7.1 litres)	7 : 1	80/87	362 lb. (164.3 kg.)	37.50 in. (952 m/m.)	32.24 in. (819 m/m.)	24.65 in. (626 m/m.)	Direct
O-435-K1 (O-435-4 military)	6	250 h.p. at 3,200 r.p.m. (T.O. 260 h.p. at 3,400 r.p.m.)	434 cub. in. (7.1 litres)	7.3 : 1	80/87	405 lb. (183.8 kg.)	—	—	—	Direct
O-435-V	6	245 h.p. at 3,100 r.p.m. (T.O. 260 h.p. at 3,400 r.p.m.)	434 cub. in. (7.1 litres)	7.3 : 1	80/87	396 lb. (179.7 kg.)	—	—	—	Direct For vertical mounting
GO-435-C2	6	240 h.p. at 3,000 r.p.m. (T.O. 260 h.p. at 3,400 r.p.m.)	434 cub. in. (7.1 litres)	7.3 : 1	80/87	422 lb. (191.5 kg.)	39.57 in. (1,005 m/m.)	33.12 in. (843 m/m.)	29.59 in. (751 m/m.)	.642 : 1
GSO-435-B	6	260 h.p. at 3,050 r.p.m. (T.O. 300 h.p. at 3,400 r.p.m.)	434 cub. in. (7.1 litres)	7.3 : 1	91/96	488 lb. (221.5 kg.)	45.75 in. (1,162 m/m.)	33.12 in. (843 m/m.)	32.24 in. (817 m/m.)	.642 : 1
GO-480	6	260 h.p. at 3,000 r.p.m. (T.O. 280 h.p. at 3,400 r.p.m.)	480 cub. in. (7.8 litres)	7.3 : 1	80/87	432 lb. (196.1 kg.)	38.64 in. (981 m/m.)	33.12 in. (842 m/m.)	34.43 in. (874 m/m.)	.642 : 1
GSO-480-B	6	280 h.p. at 3,000 r.p.m. (T.O. 340 h.p. at 3,200 r.p.m.)	480 cub. in. (7.8 litres)	7.3 : 1	80/87	492 lb. (223.3 kg.)	45.75 in. (1,162 m/m.)	33.12 in. (842 m/m.)	32.36 in. (822 m/m.)	.642: 1
GSO-580-C	8	320 h.p. at 3,000 r.p.m. (T.O. 375 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	91/98	560 lb. (254.2 kg.)	49.20 in. (1,250 m/m.)	33.18 in. (843 m/m.)	34.22 in. (869 m/m.)	.642 : 1
SO-580-D	8	350 h.p. at 3,000 r.p.m. (T.O. 400 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	100/130	560 lb. (254.2 kg.)	49.20 in. (1,250 m/m.)	33.18 in. (843 m/m.)	30.75 in. (781 m/m.)	.642 : 1
SO-580-V	8	350 h.p. at 3,000 r.p.m. (T.O. 400 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	100/130	585 lb. (265.6 kg.)	—	—	—	Direct For vertical mounting
GSO-580-D (XO-580-1 military)	8	350 h.p. at 3,000 r.p.m. (T.O. 400 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	100/130	604 lb. (274.2 kg.)	57.08 in. (1,450 m/m.)	33.18 in. (843 m/m.)	34.22 in. (869 m/m.	.642 : 1
O-580-3 military)	8	350 h.p. at 3,000 r.p.m. (T.O. 400 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	100/130	585 lb. (265.6 kg.)	—	—	—	Direct

R-1820-76B and -86. Same as -76A but for different installations.

R-1820-80. Similar to -76A but with T.O. rating of 1,475 h.p. at 2,800 r.p.m. Reduction gear ratio 0.5625 : 1.

R-1820-82. Similar to -76A but with T.O. rating of 1,525 h.p. at 2,800 r.p.m. with 115/145 Grade fuel. Reduction gear ratio 0.5625 : 1.

R-1820-84. Helicopter engine similar to -82 but with direct-drive.

R-1820-103. Helicopter engine similar to -76A but with direct-drive.

A full description of the R-1820 Cyclone 9 engine has appeared in previous editions of this Annual under "Wright."

McCULLOCH

McCULLOCH MOTORS CORPORATION.

Head Office and Works: Los Angeles 45, California.

President: Robert P. McCulloch.

Executive Vice-President: John L. Ryde.

Vice-President in charge of Engineering: Gerald Robechaud,

Vice-President in charge of Sales: C. F. Breer.

Vice-President in charge of Production: S. H. Egbert.

Secretary and Treasurer: Joseph L. Hegener.

McCulloch Motors Corpn. produces a variety of gasoline-engined products, making extensive use of high-pressure die casting of aluminium and magnesium.

Since 1943 the company has been producing engines for use in radio-controlled target aircraft. The latest engines are the Model 4318A, and 4318B, both of which are four cylinder engines, and the Model 6318, a six-cylinder engine. All these engines are described below,

THE McCULLOCH MODEL 4318A.

Military designation: O-100-1.

Type. — Four-cylinder horizontally-opposed air-cooled two-stroke.

Cylinders.—Bore $3\frac{3}{16}$ in. (80.8 mm.). Stroke $3\frac{1}{8}$ in. (79.4 mm.). Displacement 100 cub. in. (1.6 litres). Compression ratio 7.8 : 1. Heat-treated die-cast aluminium cylinders with integral heads, having hard chrome plated cylinder walls. Self-locking nuts secure cylinders to crankcase studs.

Pistons.—Heat-treated cast aluminium. Two rings above pins. Piston pins of case-hardened steel.

Connecting Rods.—Forged steel. Split big-end carries bearing rollers in heat-treated beryllium copper cages. Small-end carries two needle bearings.

Crankshaft.—Four-throw one-piece steel forging on four anti-friction bearings, two ball and two needle, one with split race for centre main bearing.

Crankcase.—One-piece heat-treated permanent-mould aluminium casting closed at rear end with cast aluminium cover which provides mounting for magneto.

Fuel System.—McCulloch diaphragm-type carburettor A.C. diaphragm type fuel pump. Fuel mixture for scavenging and power stroke introduced to cylinders through crankshaft-driven rotary valves and ported cylinders.

Fuel Specification.—Mil-F-5572 Grade 115/145 aviation fuel.

Ignition. — McCulloch single magneto and distributor. Directly connected to crankshaft through impulse coupling for easy starting. Radio noise suppressor included. BG spark plugs. Complete radio shielding.

Lubrication. — Oil mixed with fuel as in conventional two-stroke engines.

Starting.—By separate portable gasoline or electric motor with suitable reduction-gear and clutch.

Mounting. — Three mounting lugs provided with sockets for rubber mounting bushings.

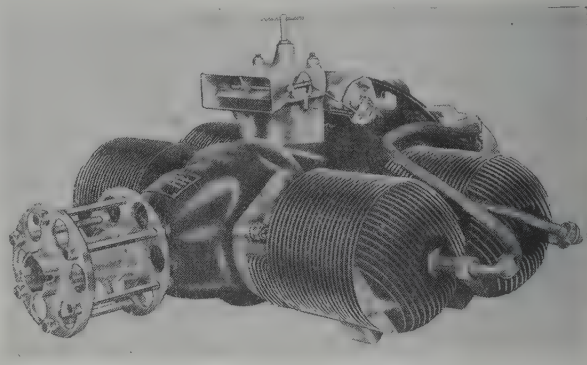
Airscrew Drive.—Direct. R.H. tractor.

Dimensions.—
Overall length 26.3 in. (66.8 cm.).
Overall width 28.0 in. (71.1 cm.).
Overall height 14.3 in. (36.3 cm.).

Weight (complete, but less airscrew hub).—77 lb. (34.9 kg.).

Power Rating.—
Rated output 72 h.p. at 4,100 r.p.m

Consumption.—
Fuel/oil mixture 0.90 lb./b.h.p./hr. (0.408 kg./b.h.p./hr.).



The 72 h.p. McCulloch four-cylinder two-stroke engine.

THE McCULLOCH MODEL 4318B.

Military designation: O-100-2.

The Model 4318B differs from the 4318A in that it employs the same cylinders, pistons and connecting-rods as the Model 6318 six-cylinder engine described later. The later design cylinder features a relocated sparking plug position which makes possible a reduction in the overall width of the engine by 6 in. (15.2 cm.). The newer pistons have three rings instead of two and the lateral position of the connecting-rod is controlled by thrust washers between the piston pin bosses and the corresponding end of the rod. The 4318B also incorporates a simple two-position altitude compensator for improved altitude performance.

In all other respects the two engines are the same.

Dimensions.—
Same as for Model 4318A except :—
Width 22.0 in. (55.8 cm.).

Weight and Performance.—
Same as for Model 4318A.

THE McCULLOCH MODEL 6318.

U.S. Military designation: O-150-2.

The Model 6318 differs from the 4318B in that it has six cylinders, a torsional vibration damper, a medium-pressure continuous fuel-injection system instead of a carburettor and a continuously-variable altitude compensator.

Type.—Six-cylinder horizontally-opposed two-stroke.

Cylinder, Pistons, Connecting Rods.—Same as for Model 4318B.

Crankshaft.—Six-throw one piece steel forging. One ball and four needle bearings, two with split race for centre main bearings.

Crankcase.—One-piece magnesium casting, heat-treated and aged.

Induction.—Continuous injection into crankcase through fixed jets. Fuel supplied and metered by McCulloch two-stage rotary-pump with altitude compensator.

Fuel Specification.—MIL-F-5572 Grade 115/145 aviation fuel.

Ignition, Lubrication, Starting and Mounting.—Same as for Model 4318B.

Dimensions.—
Overall length 35.4 in. (89.9 cm.).
Overall width 22.0 in. (55.8 cm.).
Overall height 12.3 in. (31.2 cm.).

Weight (complete, less airscrew hub).—111 lb. (50.4 kg.).

Power Rating.—
Rated output 110 h.p. at 4,100 r.p.m.

Consumption.—
Fuel/oil mixture 0.85 lb./h.p./hr. (0.38 kg./h.p.hr.).

NELSON

BARMOTIVE PRODUCTS, INC.

Head Office and Works: 440, Peralta Avenue, San Leandro, California.

President: W. W. Barton.

Vice-President and General Manager: C. H. Whitner.

Secretary and Treasurer: J. M. Hardin.

Chief Engineer and Works Manager: R. L. Sturmer.

Sales Representatives: W. F. and John Barnes Company, 301, South Water Street, Rockford, Ill.

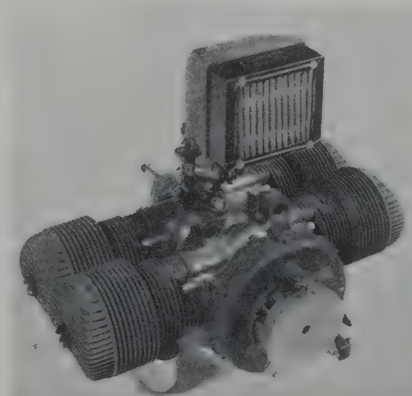
Barmotive Products, Inc., among their many industrial activities, produce the Nelson H-59 four-cylinder two-cycle air-cooled engine, which has been tested and approved by the Civil Aeronautics Authority as a power source for auxiliary-powered sailplanes. The engine has also been used as a power unit for experimental helicopters as well as for experimental craft employing the "ducted-fan" principle.

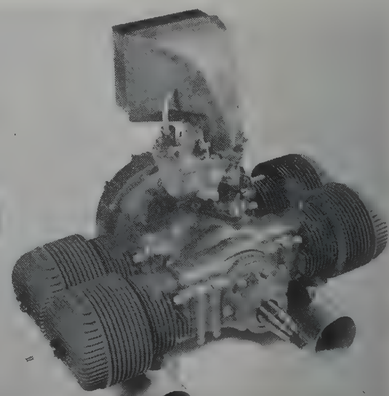
THE NELSON H-59.

The H-59 engine was designed to provide a small power-unit having a high ratio of horse-power to basic weight (40 h.p./41 lb.). Liberal use of magnesium and aluminium-alloys is made to keep the weight down to the minimum.

The thrust bearing is suitable for a pusher or tractor type propeller. Installation can be made with the crankshaft in either the horizontal or vertical position, each position requiring its own specially modified carburettor.

Type.—Four-cylinder horizontally-opposed air-cooled, two-stroke.





Two views of the 40 h.p. Nelson H-59 four-cylinder two-stroke engine.

CYLINDERS.—Bore 2⅝ in. (76 mm.). Stroke 2¾ in. (70 mm.). Displacement 59 cub. in. (0.94 litres). Compression ratio 10 : 1. Each cylinder complete is machined from an aluminium-alloy casting, the bore being porous-chrome plated for wear resistance. Cylinders bolted to and detachable from crankcase.
PISTONS.—Aluminium-alloy casting.
CONNECTING RODS.—Nitralloy with needle bearings in big and little ends.
CRANKSHAFT.—Four-throw Nitralloy shaft on four ball bearings.
CRANKCASE.—Two-piece case divided on horizontal centre-line. Each half is a magnesium casting.
INDUCTION.—Standard automobile carburettor specially modified for this engine. Carter WA-1 for horizontal operation or Carter 973-S for vertical operation. Fuel/oil mixture valved from crankcase through specially-designed rotary valve driven by crankshaft. Intake to and exhaust from cylinders through ports. Exhaust stacks are of aluminium-alloy.
FUEL.—80 octane gasoline and SAE 30 paraffin-base oil in 4 : 1 mixture for fuel and lubrication.
IGNITION.—Electrical source is 6- or 12-volt battery. Two ignition coils with standard wiring. One Champion No. 5 commercial plug per cylinder.
LUBRICATION.—See under "Fuel."
PROPELLER DRIVE.—Direct. Type of propeller varies with application. Recommended diameter for use with ultra-light aircraft or power-assisted sailplanes is 42 inches (1.06 m.).
STARTING.—Steel cable from cockpit to starter mechanism.
MOUNTING.—Four Lord-type mounts, two on each half of crankcase.
DIMENSIONS.—
Overall length 18 in. (45.7 cm.).
Overall height 17.5 in. (44.4 cm.).
Overall width 25 in. (63.5 cm.).
WEIGHTS.—
Dry, less carburettor and exhaust stacks 41 lb. (18.6 kg.).
Carburettor (with filter) 3-5 lb. (1.4-2.3 kg.).
Exhaust stacks (2) 3 lb. (1.4 kg.).
Coils (2) 3 lb. (1.4 kg.).
POWER RATING.—
Rated output 40 h.p. at 4,000 r.p.m.
CONSUMPTION.—
Fuel/oil 4.5 U.S. gallons (17 litres) per hour.

PRATT & WHITNEY

THE PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: EAST HARTFORD 8, CONNECTICUT.

Established: 1925.

General Manager: William P. Gwinn.

Engineering Manager: Wright A. Parkins.

Chief Engineer: Perry W. Pratt.

Sales Manager: T. E. Tillinghast.

Factory Manager: John L. Bunce.

Pratt & Whitney concentrates on the manufacture of high-powered gas-turbines and radial air-cooled engines. It was founded in 1925 by a small group of aeronautical engine experts as the Pratt & Whitney Aircraft Company and is now a division of the United Aircraft Corporation.

During 1953, Pratt & Whitney Aircraft retained and strengthened its position of leadership in the development and manufacture of gas-turbine and piston-type aircraft engines.

Production space in the main East Hartford, Connecticut plant and in the branch plants at North Haven, Southington and Meriden, Connecticut, totals more than 6,000,000 square feet. Employment in all Pratt & Whitney plants was over 33,000 on January 1, 1955.

While major emphasis was placed on producing the J57 turbojet engine, volume production of the R-4360 Wasp Major and the R-2800 Double Wasp piston engines continued.

The R-985 Wasp Junior is no longer in production and the R-1340 Wasp engine is now only being manufactured by the Canadian Pratt & Whitney company. The first Canadian-built R-1340 engine was completed in December, 1952.

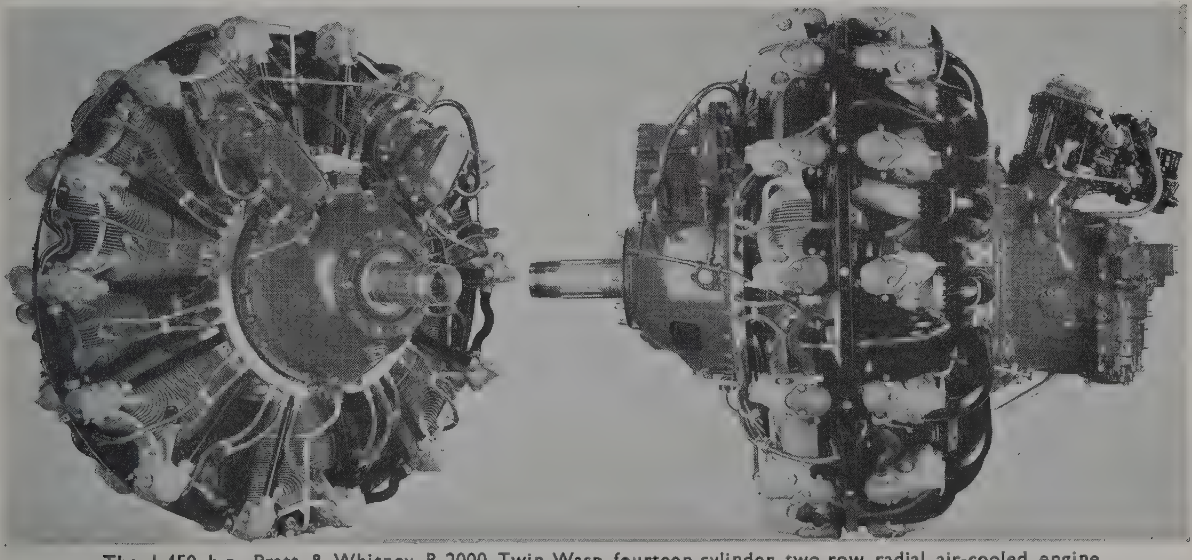
In 1954 over half of Pratt & Whitney production capacity was devoted to gas turbine engines. Details of these engines will be found in Part I of this Section.

THE PRATT & WHITNEY R-2000 TWIN-WASP D SERIES.

TYPE.—Fourteen-cylinder two-row air-cooled radial.
CYLINDERS.—Bore 5¾ in. (146 mm.). Stroke 5½ in. (139.50 mm.). Displacement 2,004 cub. in. (32.8 litres). Built up of cast aluminium head, with integral valve mechanism housing, screwed and shrunk on a forged steel cylinder barrel. Forged aluminium sleeve in which deep-cut cooling fins have been machined (muffs) are shrunk over the central portion. Each cylinder has one inlet and one exhaust valve, seating on inserts which are shrunk into head. Pressure baffles are provided.
PISTONS.—Of forged aluminium, ribbed on underside of head for additional cooling. Each piston has three compression-rings, one oil scraper-ring and one pair of dual oil control rings.
CONNECTING RODS.—The master rod cluster consists of the master rod, with detachable cap and two piece lead-silver bearing, and six I-section articulated rods for each row. Each articulated rod has bronze bushings at both piston and knuckle pin ends.
CRANKSHAFT.—Forged steel, two-throw counter-weighted, one-piece type, supported by three plain lead-silver bearings in the crankcase section.
CRANKCASE.—Made up of seven sections. The three parts for the power section, or crankcase proper, are machined together from aluminium forgings. The magnesium nose section houses the reduction gears and has provision for the Hamilton Standard Hydromatic or other full-feathering airscrews. The power sections are joined by through bolts. The magnesium blower section, bolted to the power section, contains the supercharger and carries bronze-bushed forged-steel engine mounting lugs. The blower intermediate section, bolted to the blower section, supports the downdraft carburettor and houses the impeller gear train. The accessory section, also of magnesium, is fastened to the lower intermediate section by means of stud bolts.
VALVE GEAR.—One inlet and one exhaust

THE PRATT & WHITNEY TWIN WASP R-2000 D SERIES.

Engine Model	Take-off Power	Normal Rating (low blower)	Normal Rating (high blower)	Max. Continuous Power	Compression Ratio	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
D5	1,450 h.p. at 2,700 r.p.m. at 2,800 ft. (855 m.)	1,200 h.p. at 2,550 r.p.m. at 6,400 ft. (1,952 m.)	—	—	6.5 : 1	7.15 : 1	.500 : 1	1,585 lb. (719 kg.)	49.10 in. (1.247 m.)	100/130
2SD13-G	1.450 h.p. at 2,700 r.p.m. at 1,000 ft. (305 m.)	1,200 h.p. at 2,550 r.p.m. at 5,000 ft. (1,525 m.)	1,100 h.p. at 2,550 r.p.m. at 14,000 ft. (4,265 m.)	—	6.5 : 1	7.15 : 1 (L) and 9.52 : 1 (H)	.500 : 1	1.605 lb. (728 kg.)	49.10 in. (1.247 m.)	100/130



The 1,450 h.p. Pratt & Whitney R-2000 Twin-Wasp fourteen-cylinder two-row radial air-cooled engine.

valve per cylinder. Exhaust valves are sodium-cooled and faced with stellite. Valves are actuated by plain bearing rocker arms and push-rods. Two shelf-mounted cams, one in front power section and one in rear, driven by spur reduction gears directly off the crankshaft at one-eighth crankshaft speed.

INDUCTION SYSTEM.—Stromberg pressure-injection carburettor with automatic mixture control, idle cut-off, primer tubing and distributor. Metered fuel is carried through internal passage and is thrown centrifugally through small holes in a slinger ring mounted on the impeller drive shaft. Combustion air enters the supercharger at right angles to the screen of vaporized fuel thrown from the slinger ring. Fuel air mixture after being compressed collects in the blower rim from where it is carried through intake pipes to the individual cylinders. The "washboard" impeller case provides better fuel vaporization, preventing the accumulation and flow of liquid fuel along the wall by returning it to the air stream.

SUPERCHARGER.—Either single-speed or two-speed, and is single stage. Impeller is driven by spring-loaded flexible drive gears to absorb shocks and to equalize driving loads, plus cone clutches with creeper desludgers in the case of two-speed drive engines.

IGNITION SYSTEM.—Two nose-mounted Scintilla magnetos each operate an individual set of spark-plugs through a single ignition manifold attached to the front of the power section. Magnetos, manifold and spark-plug leads are radio-shielded.

LUBRICATION.—Forced feed lubrication by a gear-type oil pump to all parts of the engine.

REDUCTION GEAR.—The planetary reduction gears of Pratt & Whitney design. Ratio .500 : 1. Airscrew shaft supported at the crankshaft end in two concentric bearings mounted in a support plate at the rear of the nose housing and at the front of the nose section by a deep-groove ball-bearing. The airscrew shaft is completely decoupled from the crankshaft.

ACCESSORY DRIVES.—All accessories are grouped in the rear and are driven through intermediate gear train by a single drive-shaft spline fitted to the rear of the crank shaft.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE PRATT & WHITNEY R-2800 DOUBLE WASP CA AND CB SERIES.

TYPE.—Eighteen-cylinder two-row air-cooled radial.

CYLINDERS.—Bore 5¾ in. (146 mm.). Stroke 6 in. (152.4 mm.). Capacity 2,804 cub. in. (45.9 litres). Built up of forged aluminium head, with integral valve mechanism housing, screwed and shrunk on a forged steel cylinder barrel. Forged aluminium sleeves in which deep-cut cooling fins have been machined, are shrunk over the central portion. Each cylinder has one inlet and one exhaust valve, the inlet seating on a bronze insert and the exhaust on a steel insert, both of which are shrunk into the head. Pressure baffles are provided.

PISTONS.—Forged aluminium pistons of full skirt type. Three compression rings, one pair of dual oil control rings and one oil scraper ring. Top compression ring chromium plated on the face which bears against the cylinder wall.

CONNECTING RODS.—The rod assembly consists of a one-piece master rod and eight I-section articulated rods attached to each master rod by knuckle pins. The master rod bearings are one-piece steel shells covered on the inside and outside with leaded silver. The articulated rods have bronze bushings at the piston pin end and ride on silvered knuckle pins at the knuckle pin end.

CRANKSHAFT.—Two-throw crankshaft machined from three steel forgings which divide at the crankpins and are joined together by a face spline and bolt. Crankshaft assembly supported by steel-backed lead-silver bearings mounted in the front, centre and rear main crankcase sections. Weights of reciprocating and rotating parts connected to the crankpin are counterbalanced by weights, the front counter balance and a portion of the improved rear one being mounted as bifilar dampers. Mounted at each end of the crankshafts are two counterweights revolving at twice-crankshaft speed to eliminate second-order "whirl."

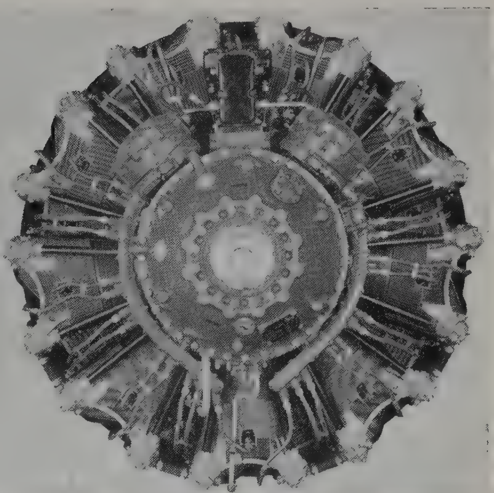
CRANKCASE.—Main crankcase composed of three forged aluminium-alloy sections held together by through bolts. Nose-section houses the reduction gears and torquemeter and has provisions for full-feathering, reversible governor. Supercharger case attached to the rear of the main crankcase section and also houses an impeller. Intermediate rear case is attached to supercharger case and supports at its forward face a vaned diffuser plate and provides mounting surface for a pressure type carburettor. Rear section provides accessory mounting pads.

REMARKS.—The valve gear, induction-system, supercharger, ignition system, lubrication system and accessory-drives are substantially the same as in the Twin-Wasp. The ignition system is optionally high or low voltage. Water-injection equipment may be used with the "CA" Double-Wasp to

THE PRATT & WHITNEY R-2800 DOUBLE WASP CA AND CB SERIES.

Engine Model	Take-off Power	Normal Rating (low blower)	Normal Rating (high blower)	Max. Continuous Power (low blower)	Max. Continuous Power (high blower)	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
*CA3	‡2,400 h.p. at 2,800 r.p.m. 2,100 h.p. at 2,800 r.p.m. at 3,000 ft. (915 m.)	1,800 h.p. at 2,600 r.p.m. at 6,000 ft. (1,830 m.)	—	1,900 h.p. at 2,600 r.p.m. at 4,000 ft. (1,220 m.)	—	7.29 : 1	.45 : 1	2,317 lb. (1,051 kg.)	52.8 in. (1,342 mm.)	100/130
†CA15	‡2,400 h.p. at 2,800 r.p.m. 2,100 h.p. at 2,800 r.p.m. at 3,000 ft. (915 m.)	1,800 h.p. at 2,600 r.p.m. at 6,000 ft. (1,830 m.)	1,600 h.p. at 2,600 r.p.m. at 16,000 ft. (4,880 m.)	1,900 h.p. at 2,600 r.p.m. at 4,000 ft. (1,220 m.)	1,600 h.p. at 2,600 r.p.m. at 16,000 ft. (4,880 m.)	7.29 : 1 (L) 9.45 : 1 (H)	.45 : 1	2,350 lb. (1,066 kg.)	52.8 in. (1,342 mm.)	100/130
†CA18	‡2,400 h.p. at 2,800 r.p.m. 2,100 h.p. at 2,800 r.p.m. at 3,000 ft. (905 m.)	1,800 h.p. at 2,600 r.p.m. at 6,000 ft. (1,830 m.)	1,600 h.p. at 2,600 r.p.m. at 14,500 ft. (4,420 m.)	1,900 h.p. at 2,600 r.p.m. at 4,000 ft. (1,220 m.)	1,675 h.p. at 2,600 r.p.m. at 13,500 ft. (4,115 m.)	7.29 : 1 (L) 9.1 : 1 (H)	.45 : 1	2,350 lb. (1,066 kg.)	52.8 in. (1,342 mm.)	100/130
*CB3	‡2,400 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.) 2,050 h.p. at 2,700 r.p.m. at 6,000 ft. (1,830 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	—	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	—	7.29 : 1	.45 : 1	2,357 lb. (1,070 kg.)	52.8 in. (1,342 mm.)	100/130
*CB4	‡2,500 h.p. at 2,800 r.p.m. at 2,500 ft. (760 m.) 2,200 h.p. at 2,800 r.p.m. at 4,500 ft. (1,370 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	—	1,900 h.p. at 2,600 r.p.m. at 7,000 ft. (2,135 m.)	—	7.29 : 1	.45 : 1	2,357 lb. (1,070 kg.)	52.8 in. (1,342 mm.)	108/135
†CB16	‡2,400 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.) 2,050 h.p. at 2,700 r.p.m. at 6,000 ft. (1,830 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	1,600 h.p. at 2,600 r.p.m. at 16,000 ft. (4,880 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	1,700 h.p. at 2,600 r.p.m. at 14,500 ft. (4,420 m.)	7.29 : 1 (L) 8.58 : 1 (H)	.45 : 1	2,390 lb. (1,084 kg.)	52.8 in. (1,342 mm.)	100/130
†CB17	‡2,500 h.p. at 2,800 r.p.m. at 2,500 ft. (760 m.) 2,200 h.p. at 2,800 r.p.m. at 4,500 ft. (1,370 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	1,700 h.p. at 2,600 r.p.m. at 14,500 ft. (4,420 m.)	1,900 h.p. at 2,600 r.p.m. at 7,000 ft. (2,135 m.)	1,750 h.p. at 2,600 r.p.m. at 13,500 ft. (4,115 m.)	7.29 : 1 (L) 8.58 : 1 (H)	.45 : 1	2,390 lb. (1,084 kg.)	52.8 in. (1,342 mm.)	108/135

* Single-speed single-stage supercharger. † Two-speed single-stage supercharger. ‡ With water injection.



The 2,400 h.p. Pratt & Whitney R-2800 Double-Wasp CA and CB Series eighteen-cylinder radial engine.

give the added power for take-off and emergencies.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE PRATT & WHITNEY R-4360 WASP MAJOR CB SERIES.

TYPE.—Twenty-eight-cylinder four-row air-cooled radial.

CYLINDERS.—Bore 5¾ in. (146 mm.). Stroke 6 in. (152.4 mm.). Capacity 4,363 cub. in. (71.5 litres). Cylinders, which are similar to those of R-2800 Series, are arranged helically around the crankcase and pressure baffles are provided for individual cylinders and for each bank of four. All cylinders are completely interchangeable.

PISTONS.—Generally the same as for the Double Wasp, with reinforced internal bosses.

CONNECTING RODS.—Rod assembly for each row of seven cylinders consists of master rod with detachable cap, two-piece lead-silver bearing, and six I-section articulated or link rods. Each link rod has a bronze bushing at the piston end and rides on a silvered knuckle pin.

CRANKSHAFT.—One-piece crankshaft of forged steel has four throws and is supported in the crankcase by five steel-backed lead-silver main bearings. Weights of the reciprocating parts connected to the crankpin are counterbalanced by two fixed and two bifilar counterweights.

AIRSCREW SHAFT.—Supported at the crankshaft end by a plain lead-bronze bearing and at the airscrew end by a roller-bearing to carry radial loads and a deep-groove ball-bearing which absorbs engine thrust.

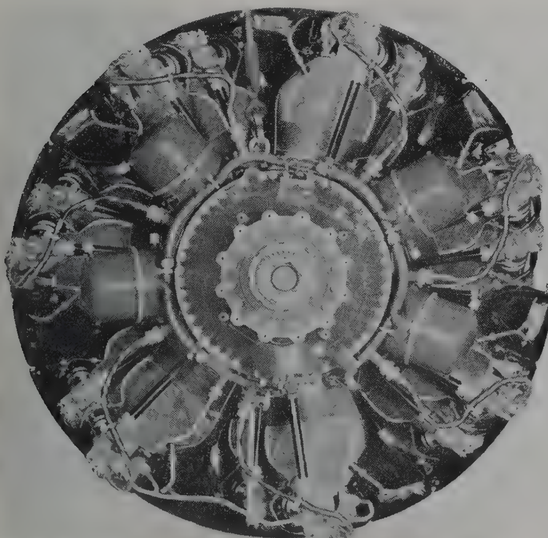
CRANKCASE.—The power section case made up of five sections, all except the front and rear sections being substantially alike. The parts for the power section are machined from aluminium forgings and are held together with through bolts. All other crankcase sections are magnesium castings. Attached to front of power section by studs is the magneto section, which mounts seven interchangeable magnetos and contains the torquemeter. The nose section houses the planetary reduction gearing and has provision for full-feathering, reversible airscrew governor. Attached to rear of power section by studs is the supercharger housing, enclosing the supercharger drives and impeller. Behind the supercharger housing, also attached with studs, is the accessory section. On this is mounted a down-draft pressure-type carburettor. This section houses the accessory-drive mechanism and provides mounting pads for the radial mounting of all accessories and automatic power controls to permit greater accessibility for servicing. Normally nothing is mounted on the rear of the engine but a co-axial accessory drive may be provided as optional equipment.

VALVE GEAR.—Rocker boxes are part of the cylinder head, extending fore and aft. Rocker arms with plain bearings are actuated by enclosed push-rods. Double-track shelf-mounted cams inside the crankcase

THE PRATT & WHITNEY R-4360 WASP MAJOR CB SERIES.

Engine Model	Take-off Power	Normal Rating	Max. Continuous Power	Compression Ratio	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
CB2	‡3,500 h.p. at 2,700 r.p.m. at 500 ft. (150 m.) 3,250 h.p. at 2,700 r.p.m. at 700 ft. (215 m.)	2,650 h.p. at 2,550 r.p.m. at 5,500 ft. (1,675 m.)	2,800 h.p. at 2,550 r.p.m. at 3,500 ft. (1,070 m.)	6.7 : 1	6.375 : 1	.375 : 1	3,682 lb. (1,670 kg.)	55 in. (1,397 mm.)	108/135

‡ With water injection. Note: The CB2 Model is suitable for use with exhaust-driven supercharger.



The 3,350 h.p. Pratt & Whitney R-4360 CB Series four-row radial air-cooled engine.

between the rows of cylinders operate the exhaust valves of the forward row of cylinders and the intake valves of the aft row. Cams are driven by spur reduction-gears from the crankshaft at one-sixth crankshaft speed.

INDUCTION SYSTEM.—Stromberg four-barred pressure-type carburettor, with automatic mixture control, idle cut-off, primer tubing and distributor. Metered fuel is carried through internal passages and is thrown centrifugally through small holes between the impeller blades to mix with the combustion air. The fuel-air mixture, after passing through the diffuser to the blower rim, is carried to the cylinders through seven intake pipes, one for each bank of four cylinders.

SUPERCHARGER.—There are two basic types in unrestricted engines: a single-stage single-speed supercharger suitable for use with an exhaust driven turbo-supercharger, and a single-stage hydraulically-driven variable-speed supercharger. The two-piece impeller assembly consists of a machined impeller, the straight blades of which are blended with the curved entrance blades of an inducer.

IGNITION SYSTEM.—Four Scintilla magnetos, each with an integral distributor, operate at one-half crankshaft speed. Dual ignition.

LUBRICATION.—Forced-feed lubrication provided by a gear-type oil pump to all parts of the engine.

REDUCTION GEAR.—The planetary reduction gears are of Pratt & Whitney design and are spur gears with ratio of .375 : 1.

ACCESSORY DRIVES.—All accessories mounted radially on the periphery of the rear section. All accessory-drive gears driven by a bevel-gear revolving at crankshaft speed.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

WRIGHT

WRIGHT AERONAUTICAL DIVISION, CURTISS-WRIGHT CORPORATION.

HEAD OFFICE AND WORKS: WOOD-RIDGE, N.J.

Chairman of the Board and President: Roy T. Hurley.

Vice-President and General Manager: J. V. Miccio.

Vice-President and Chief Engineer: W. G. Lundquist.

The Wright Aeronautical Corporation merged with the Curtiss Aeroplane and Motor Company in 1929 to form the Curtiss-Wright Corporation, of which Wright Aeronautical is now the largest division.

Wright piston engines range in power from 800 to 2,800 horsepower, while the Wright Turbo Compound, a combination piston and turbine engine which develops over 3,700 h.p., is also in quantity production and is the only compound engine powering production aircraft.

All Lockheed Constellation airliners are powered by four Wright R-3350 eighteen-cylinder engines. The Wright Turbo Compound engine powers the Lockheed P2V and WV and Martin P5M patrol aircraft and the Lockheed R7V-1 transport in service in the U.S. Navy, as well as the Fairchild C-119 and Lockheed C-121 transports of the U.S.A.F. The Turbo Compound also powers the later versions of the Super Constellation and the new Douglas DC-7 airliner.

Production of the R-1300 Cyclone 7 Series and R-1820 Cyclone 9 Series engines is now handled exclusively by the Lycoming Division of the AVCO Manufacturing Corporation. For details of the current production versions of these two engines see under "Lycoming."

Wright is also in production with the J65 turbojet engine, details of which will be found in Part I of this Section.

In addition to the further development of existing power-units and a series of turbojet and turboprop engines, Wright is also actively engaged in a ramjet development programme for guided missile application.

THE WRIGHT R-3350 CYCLONE 18 SERIES.

TYPE.—Eighteen-cylinder double-row geared and supercharged radial air-cooled.

CYLINDERS.—Bore 6.125 in. (155.6 mm.). Stroke 6.312 in. (160.2 mm.). Capacity 3,347 cub. in. (54.56 litres). Universal-type forged head with "course/fine" finning and increased finning in area of exhaust-valve for improved cooling. Forged head has greater total cooling area than cast type used on earlier C18's. Rocker boxes are slightly smaller than type previously used and are held in place by five studs.

PISTONS.—Tapered interior to accommodate tapered articulated and master-rod ends. Five piston rings, three oil and two compression.

CONNECTING RODS.—Gudgeon-pin end of articulated rods tapered to accommodate maximum thrust on down stroke and lesser thrust on return stroke. Gudgeon-pin and knuckle pin bearings of bronze. Silver master-rod bearing is steel-backed and end-sealed. All rods shot-peened during manufacture.

CRANKSHAFT.—Two-throw forged steel crankshaft dynamically-balanced with single-weight second-order balancers concentric with crankshaft.

CRANKCASE.—Eight-piece crankcase. Power section of forged steel front and rear sections of magnesium-alloy. Front or nose section in two pieces to facilitate maintenance. Reduction gears are "high overlap" type for increased tooth contact. Ball thrust-bearing mounted in front section and roller-main bearings mounted in webs of crankcase power section. Electric torque pressure indicator and provision for double-acting hydraulic airscrew provided in front section.

VALVE GEAR.—Valve seats Stellite-faced and shrunk into aluminium-alloy head. Rocker-arm ratio 1 : 1. Rocker-arms pivot on plain bearings. Push-rods enclosed in tubular housings with gland-type seals.

FUEL METERING.—BA, BD and CA models manufactured with direct fuel-injection. Fuel-injection equipment includes two nine-cylinder pumps, master control, equalizer, bar fuel lines and cylinder injection nozzles. Supercharger impeller is new "inducer" type which improves both efficiency and capacity of impeller. "Siamese" Y-type intake pipes serve two cylinders each. Some CA models inject fuel at supercharger impeller.

LUBRICATION.—Dry sump. Front sump pump scavenges to rear pump which supplies oil at pressure for lubrication. Front sump also has regulator for reduction-gear pressure. Crankcase has stationary oil jets built in.

IGNITION.—Either high or low-tension. Low-tension type includes one generator mounted on rear cover, two 18-point distributors mounted on front section and distributing low-tension current to high-tension coil on each cylinder. This system cuts leakage and arcing and eliminates long travel of high-tension current. No supercharging of ignition system necessary for high-altitude flights.

ACCESSORIES.—Rear cover strengthened for mounting of power take-off for cabin supercharging, etc. Double acting airscrew pitch control torquemeter, priming system, fire-seal adapter flange, cooling-air deflectors, accessory drives and covers, Scintilla magnetos.

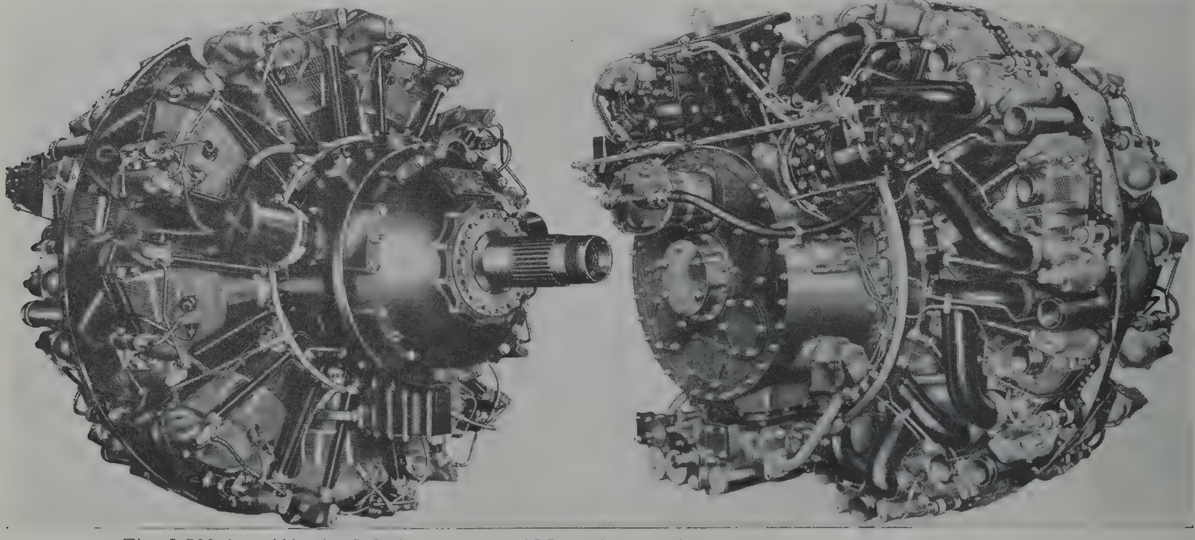
OPTIONAL EQUIPMENT.—Manifold pressure regulator, .35, .4375 or .5625 reduction gears, anti-detonant (water injection) equipment.

DIMENSIONS.—
Diameter 55.62 in. (1,413 mm.).
Length (Models 956 and 975) 78.54 in. (1,995 mm.).
Model 749 (fuel injection) 78.52 in. (1,994 mm.).

WEIGHTS AND PERFORMANCE.—
See Table.

THE WRIGHT TURBO COMPOUND.

The Turbo Compound combines an improved design R-3350 engine and three exhaust-driven "blow-down" turbines equally disposed around the engine on an extension of the rear cover. Power recovered from the engine exhaust gases by the turbines is fed back into the rear of the engine crankshaft by means of a gear train operating in conjunction with three fluid couplings. This compounding arrangement is claimed to convert into



The 2,500 h.p. Wright R-3350 Cyclone 18BD eighteen-cylinder two-row radial air-cooled engine.

THE WRIGHT R-3350 CYCLONE 18 SERIES.

Engine Model	Take-off Horsepower	Normal Rating (low blower)	Normal Rating (high blower)	Compression Ratio	Blower Ratio	Reduction Gear Ratio	Dry Weight	Fuel Grade
745C18BA1 (Fuel Injection)	2,200 h.p. at 2,800 r.p.m.	2,000 h.p. at 2,400 r.p.m. at 4,800 ft. (1,465 m.)	1,800 h.p. at 2,400 r.p.m. at 18,000 ft. (5,490 m.)	6.5 : 1	6.46 : 1 and 8.67 : 1	.4375	2,670 lb. (1,212 kg.)	100/130
749C18BD1 (Fuel Injection)	2,500 h.p. at 2,800 r.p.m.	2,100 h.p. at 2,400 r.p.m. at 4,400 ft. (1,340 m).	1,800 h.p. at 2,400 r.p.m. at 16,000 ft. (4,880 m.)	6.5 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	2,884 lb. (1,309 kg.)	100/130
956C18CA1 (Fuel Injection)	2,700 h.p. at 2,800 r.p.m.	2,700 h.p. at 2,600 r.p.m. at 6,300 ft. (1,920 m.)	2,000 h.p. at 2,600 r.p.m. at 15,800 ft. (4,820 m.)	6.7 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	2,957 lb. (1,342 kg.)	115/145
975C18CA1 Fuel Injection)	2,800 h.p. at 2,900 r.p.m.	2,400 h.p. at 2,600 r.p.m. at 4,800 ft. (1,465 m.)	2,000 h.p. at 2,600 r.p.m. at 15,700 ft. (4,790 m.)	6.7 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	3,029 lb. (1,375 kg.)	115/145

useful power approximately 20 per cent. of the available heat energy normally lost through the engine exhaust. The turbines are called "blow-down" turbines because the high velocity of the gases they use comes from the gas blowing down across the exhaust valve.

The Turbo Compound engine completed its first 50-hour Official Flight Approval Test in October, 1949, and in January, 1950, the 150-hour Official Navy Qualification Test was completed. Delivery of the first production engines began in March, 1950.

The Turbo Compound may be installed in existing types of aircraft fitted with the standard Cyclone 18 engine. The diameter of the Turbo Compound is similar to that of the Cyclone 18 and the overall length is increased by only a few inches, so that the new engine fits within the cowling lines of existing installations with a minimum of modification.

Tests conducted by the Wright Aeronautical Division indicate that a given aircraft powered with the Turbo Compound engine can (*a*) fly 20 per cent. further for the same fuel consumption than it can if equipped with the conventional type ; or (*b*) operate the same range with 20 per cent. less fuel.

The following are some of the pertinent characteristics of the Turbo Compound engine :—

Commercial Designation. — 972TC18DA-1, -2, -3, -4 and EA-1.

Cylinders.—Bore 6.125 in. (155.6 mm.). Stroke 6.312 in. (160.2 mm.). Swept volume 3,347 cub. in. (54.56 litres). Compression ratio 6.7 : 1. Developed from C18BD1 forged cylinder with 40 per cent. more cooling fin area, additional attaching threads and increased radii at stress concentration points.

Crankshaft.—Two-throw 180° shaft in three sections as in C18 Series, but material added to centre and gear crank checks to increase strength of crankshaft assembly.

Valve Gear.—As in C18 Series except that both inlet and exhaust valves are sodium-cooled. Valve stem diameter also increased from $\frac{11}{16}$ in. to $\frac{3}{4}$-in. to provide extra margin of strength. Valve guides of HC-250, a high-carbon ($2\frac{3}{4}$ per cent.) high chromium (25 per cent.) cast structure bordering on tool steel analysis. Stellite split-ring floating type valve seats shrunk into head.

Supercharger.—Two-speed, gear-driven off extension shaft coupled to rear of engine crankshaft. Blower ratios 6.46 and 8.67 : 1.

Power Recovery Turbine System.—Consists of three "blow-down" exhaust-driven turbine units clamped and indexed to adapters bolted to engine front supercharger casing. Each turbine fed by exhaust from six cylinders through three paired pipes, two pairing adjacent cylinders in front and rear rows respectively, and one pairing adjacent front and rear cylinders. Turbine wheel has Haynes Stellite No. 31 buckets welded to Inconel X disc and is splined to stainless steel shaft aligned by two steel-backed silver bearings mounted at either end of shaft support pedestal. Turbine shafts are geared to extension shaft coupled to rear of engine crankshaft through three vortex-flushed fluid couplings using engine oil. Turbine cooled by ram air ducted from front of engine into enclosing muff and forced by 7-in. impeller on shaft through holes at base of each wheel bucket into upper turbine shroud with tangential outlet discharging into exhaust outlet. Turbine shaft support pedestal on spring diaphragm to permit wheel to move slightly in all radial directions. Upper end of pedestal equipped with plate-type friction damper in which half the plates are fixed to turbine nozzle support and half to pedestal. Loading between plates provided by eight springs compressed to pre-determined load. Lubricating oil supplied to turbine unit from drilled passage in front supercharger housing and is scavenged by gravity drain.

Airscrew Reduction Gear Ratio.—
O-4375 : 1.

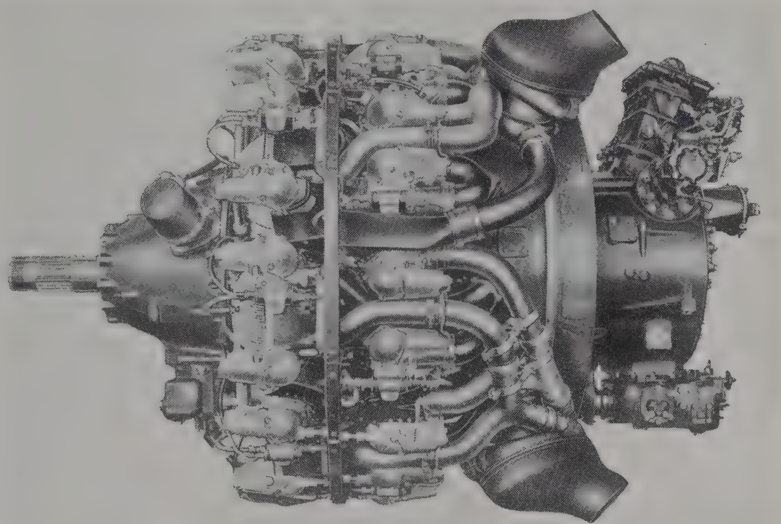
Fuel Grade.—115/145.

Diameter (without cowling).—
56.6 in. (1,438 mm.).

Dry Weight.—
3,514 lb. (1,595 kg.).

Performance.—
- Max. T.O. output over 3,500 h.p. at 2,900 r.p.m.
- Normal cruise output (71% power) 1,910 h.p. at 2,400 r.p.m. at 11,400 ft. (3,480 m.) low blower.

Consumptions.—
- Guaranteed fuel consumption (static) 0.391 lb./h.p./hr. (0.177 kg./h.p./hr.) at 50% power.
- Max. oil consumption 33 lb./hr. (15 kg./hr.) at 89% of rated speed.



The 3,350 h.p. Wright Turbo Compound engine.

THE
WORLD'S AIRSHIPS

(CORRECTED TO JULY 31st, 1955)

UNITED STATES OF AMERICA

The United States Navy is the only service in the World which operates airships and the sole supplier of airships to the U.S. Navy is the Goodyear Aircraft Corporation. Details of the current productions Goodyear appear below.

In 1954 the U.S. Navy abandoned the former classification of its airships and introduced a designation system similar to that used for naval aircraft, in which letters are used to define the function and identity of the craft and numbers to indicate the model and its modifications. The prefix Z signifies Lighter-than-Air, while the letter G identifies the Goodyear Aircraft Corporation. Other letters used i.e. P (patrol), S (search) and W (warning), are standard for all types of naval aircraft.

The previous designations and the new designations for all airships currently in service in, or in production for, the U.S. Navy are listed below :—

Old	*New*
ZP2K	ZSG-2
ZP3K	ZSG-3
XZP4K-1	XZSG-4
ZP4K-1	ZSG-4
XZP5K-1	XZS2G-1
ZP5K-1	ZS2G-1
ZPN-1	ZPG-1
ZP2N-1	ZPG-2
ZP2N-1W	ZPG-2W

The former L and G Class ships (old designations ZTL and ZTG) are no longer in service. They were formerly employed for pilot training but have now been replaced by the ZSG-2 and ZSG-3, which are modernised versions of the original K Class (or ZPK) airships.

GOODYEAR

The Goodyear ZSG-4 Search and Anti-submarine Airship which is in production for the U.S. Navy.

THE GOODYEAR AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS : AKRON 15, OHIO.

President : P. W. Litchfield.

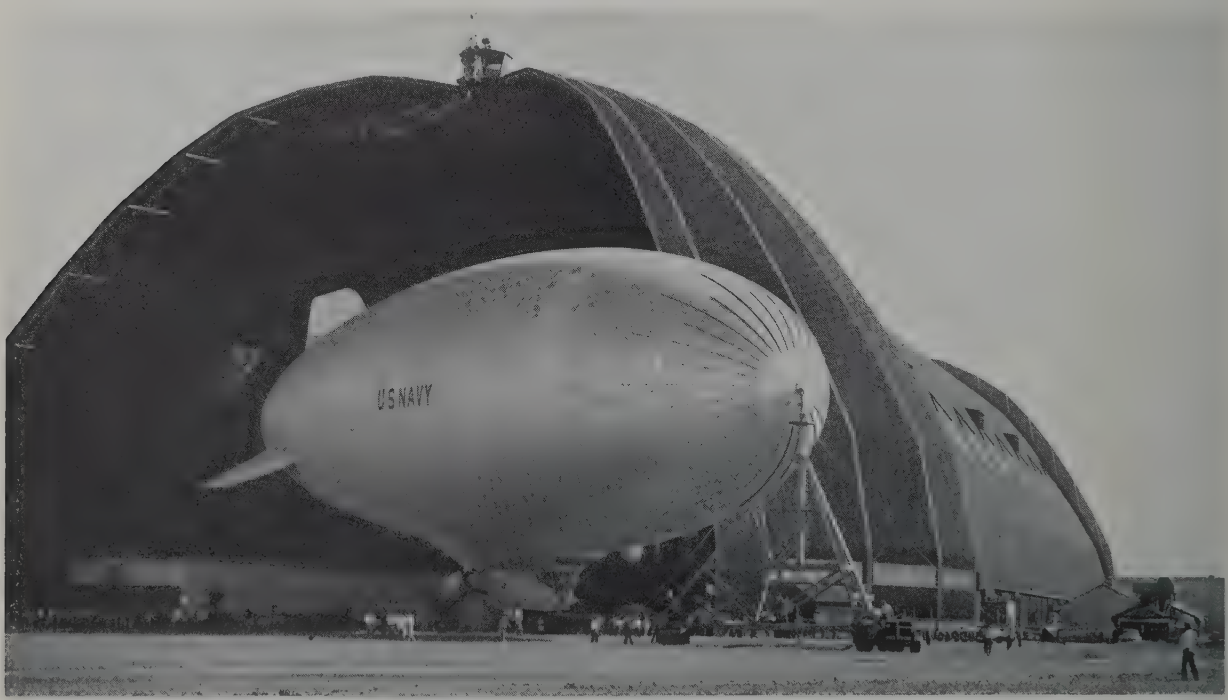
Vice-President and General Manager : T. A. Knowles.

Vice-President in charge of Engineering : Dr. Karl Arnstein.

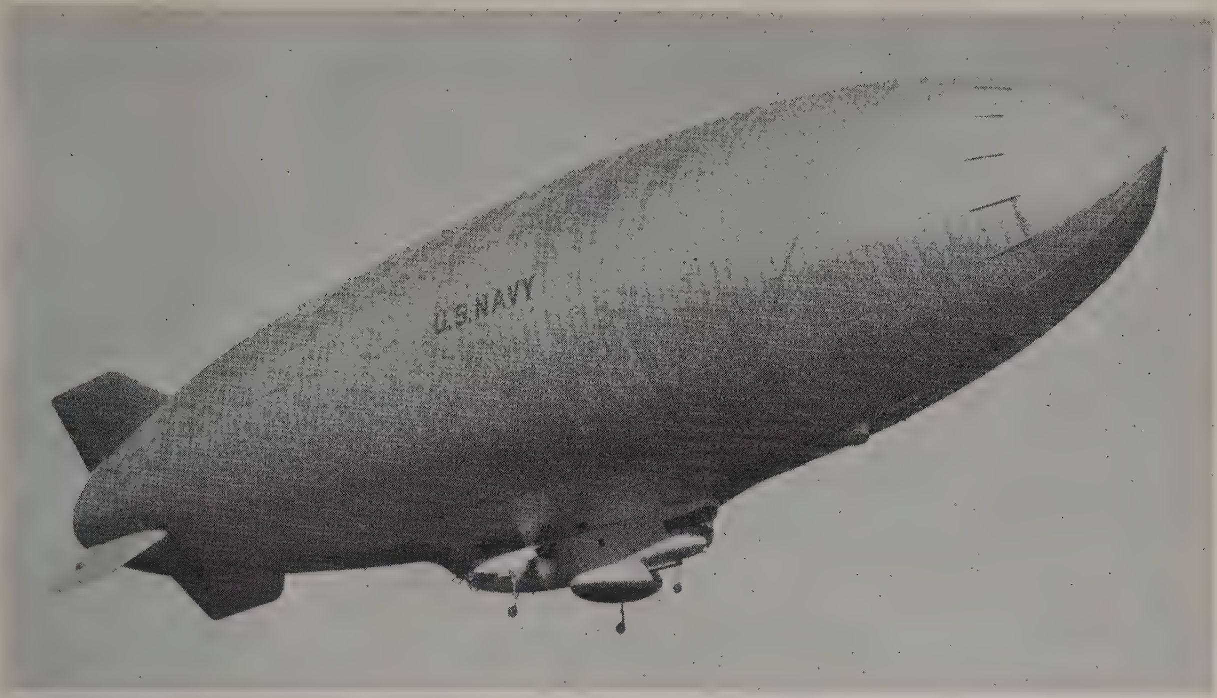
Secretary : G. F. Clayton.

The Goodyear Aircraft Corpn. was formed on December 5, 1939, to take over from the parent Goodyear organization its principal manufacturing operations in the field of aeronautics, with the exception of tyres, inner tubes, bullet-proof fuel tanks and other rubber accessories. This also included the activities of the former Goodyear-Zeppelin Corpn., then mainly devoted to lighter-than-air craft.

During the war the Corporation was engaged in the manufacture of airships, aircraft, aircraft components and sub-assemblies. In the lighter-than-air field Goodyear fulfilled for the U.S. Navy a programme of upwards of 200 airships ranging from the L-type trainers of 123,000 cub. ft. (3,480 m.^{3}) capacity to the K and M patrol ships having a helium gas capacity of 456,000 cub. ft. (12,905 m.^{3}) and 725,000 cub. ft. (20,520 m.^{3}) respectively. After the completion of the airship programme in April, 1944, the activities of the Corporation were devoted solely to the production of aircraft, parts



The Goodyear XZS2G-1, prototype of a new class of Search Airship for the U.S. Navy.



The Goodyear ZPG-2 Patrol Airship (two 800 h.p. Wright R-1300 engines) which established a new endurance record in May, 1954, by remaining in the air for 200.4 hours.

and sub-assemblies, as well as the manufacture of Goodyear wheels, brakes and other specialised components.

To-day, the Goodyear Aircraft Corpn. continues its rôle as the sole supplier of airships to the U.S. Navy's lighter-than-air section.

All Goodyear airships are of semi-rigid construction, the nose and tail sections being rigid and the centre section non-rigid. The cars are supported by a system of steel cables laced through the top and bottom of the rubberised-fabric envelope. The metal framework of the control cars is built in several assemblies and then joined together. Goodyear Bondolite Sandwich material consisting of aluminium-alloy facings with a balsa wood core, is used extensively in the construction of the control cars.

THE GOODYEAR ZSG-4.

The ZSG-4 (formerly designated ZP4K-1) non-rigid airship, an intermediate search craft, is a development of the well-known former K-type of ship. The maiden flight of the prototype was made in December, 1953, and Goodyear is now under contract to build an undisclosed number of this type of airship for the U.S. Navy.

The ZSG-4 incorporates the latest developments adaptable to such craft for the purpose of locating and attacking submarines. Operational versatility and endurance is augmented with special equipment providing for in-flight refueling and for re-ballasting by a water pick-up system.

The ZSG-4 has a helium capacity of 527,000 cub. ft. (14,915 m.^{3}), has a maximum speed in the neighbourhood of 75 m.p.h. (120 km.h.) and is manned by a crew of eight officers and ratings.

No further details are available for publication.

THE GOODYEAR XZS2G-1.

The XZS2G-1 (formerly XZP5K-1) is the first of a new class of non-rigid airship which is intended to replace the earlier K ships which were used in anti-submarine warfare service in the last war.

A notable feature of the new ship is the inverted "Y" configuration of the three control surfaces aft, an arrangement evolved to prevent the accumulation of snow on the side control surfaces.

The XZS2G-1 is equipped with the latest developments adaptable to such craft for detecting, locating and attacking submarines. The airship can refuel in flight from surface craft and re-ballast by a water pick-up system. A crew of eight is carried.

An undisclosed number of ZS2G-1 ships are being built for the U.S. Navy. Car construction and assembly is undertaken at Goodyear's Akron factory, while the envelopes are being made at the company's Litchfield Park, Arizona, factory.

THE GOODYEAR ZPG-2.

The first new patrol ship to be built since the war was the ZPN-1, now designated ZPG-1, which was flown for the

The Goodyear ZPG-2W Early Warning version of the ZPG-2 Patrol Airship.

first time in 1951. As the result of extensive evaluation trials with this ship an improved and slightly larger version, the ZP2N-1, was put into production, the first P2N ship, since re-designated ZPG-2, making its maiden flight on March 20, 1953.

The ZPG-2 has a helium capacity of 975,000 cub. ft. (27,590 m.^{3}). It is powered by two 800 h.p. Wright R-1300-2A radial air-cooled engines mounted in an engine room within the car and driving through shafts and gearing two 16 ft. 7 in. (5.06 m.) Curtiss Electric three-blade controllable-pitch, feathering and reversible propellers mounted on out-riggers projecting from each side of the car. In an emergency either engine can drive both propellers. Both engines are accessible for maintenance and repair in flight, if necessary.

The control car, which accommodates a crew of fourteen officers and ratings, has two decks, with all operational stations on the lower deck and crew's quarters on the upper deck.

A tricycle landing-gear, comprising a nose wheel and two larger wheels, one under each propeller outrigger, is retractable.

The four control surfaces on the stern of the ship are mounted at 45 degree angles from the vertical and horizontal and as all surfaces are operated in unison for either vertical or horizontal control they are known collectively as "ruddevators."

The flight controls are subject to manual or automatic pilot operation. The pilot may control both vertical and horizontal direction alone or, in co-operation with a co-pilot may divide the duties of maintaining altitude and direction. All controls can be operated through a single column, which is duplicated at the pilot and co-pilot stations.

The ZPG-2 has the latest developments adaptable to aircraft for locating and attack submarines.

Special equipment will permit the ship to refuel in flight from a surface craft or to re-ballast from the ocean through a water pick-up system.

The ship's envelope is made of Neoprene-coated cotton and the control car is constructed of a sandwich material comprising a balsa wood core faced with aluminium-alloy sheet.

The first ZPG-2 set up a new World's Endurance Record in May, 1954, by remaining in the air for 200.4 hours.

For further details see Table.

THE GOODYEAR ZPG-2W.

The ZPG-2W is an AEW (Aircraft Early Warning) version of the ZPG-2 which was initially designed for anti-submarine operations. The 2W modification incorporates changes in the electronic equipment and the addition of a large radome, containing special electronic devices for aircraft detection, on top of the envelope. A 75-foot vertical tunnel of rubberised fabric with stiffeners is built inside the envelope to connect the electronic station on top of the envelope with the control car. In all other respects the ZPG-2W is similar to the previously-described ZPG-2.

GOODYEAR AIRSHIPS BUILT FOR THE U.S. NAVY.

Class	Volume	Length	Height	Width	Engines	Max. Speed m.p.h. (km.h.)	Remarks
ZSG-2 and ZSG-3	456,000 cub. ft. (12,900 m.^{3})	253 ft. (77 m.)	79 ft. (24.0 m.)	65 ft. (19.8 m.)	2×550 h.p. Pratt & Whitney Wasp	over 75 m.p.h. (120 km.h.)	Originally K Class Ships, the first of which was launched on December 8, 1938. 130 built during last war. U.S. Navy has modified many K ships to ZSG-2 (formerly P2K) and ZSG-3 (formerly P3K) standards with latest electronic equipment and increased power (550 h.p. Pratt & Whitney Wasp engines). Now used for training.
ZSG-4	527,000 cub. ft. (14,915 m.^{3})	—	—	—	2×550 h.p. Pratt & Whitney Wasp	over 75 m.p.h. (120 km.h.)	Development of former K Class as an intermediate search craft. Prototype flew in December, 1953. In production.
XZS2G-1	—	—	—	—	—	—	Newly-designed replacement of the former K Class ships. No details available for publication. Prototype flew on July 22, 1954. In production.
ZPG-1	875,000 cub. ft. (24,760 m.^{3})	324.4 ft. (98.8 m.)	94.5 ft. (28.8 m.)	73.5 ft. (22.4 m.)	2×800 h.p. Wright R-1300 Cyclone 7	over 85 m.p.h. (136 km.h.)	Completed in 1951. Prototype only.
ZPG-2	975,000 cub. ft. (27,590 m.^{3})	343 ft. (104.6 m.)	96.5 ft. (29.4 m.)	75.5 ft. (23.0 m.)	2×800 h.p. Wright R-1300-2A Cyclone 7	over 85 m.p.h. (136 km.h.)	First production ZPG-2, which made its first flight on March 20, 1953. Established a new endurance record by remaining in the air for 200.4 hours from May 17 to 24, 1954. ZPG-2W is special Early Warning version.

INDEX SECTION

In addition to references to all items in this edition, each index contains references to every aircraft and engine described in the nine previous editions of Jane's "ALL THE WORLD'S AIRCRAFT" going back to and including 1945-46.

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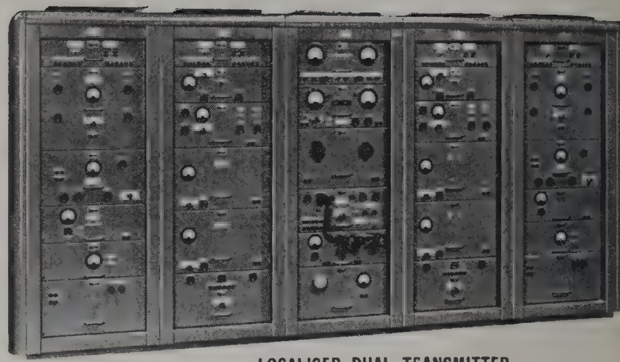
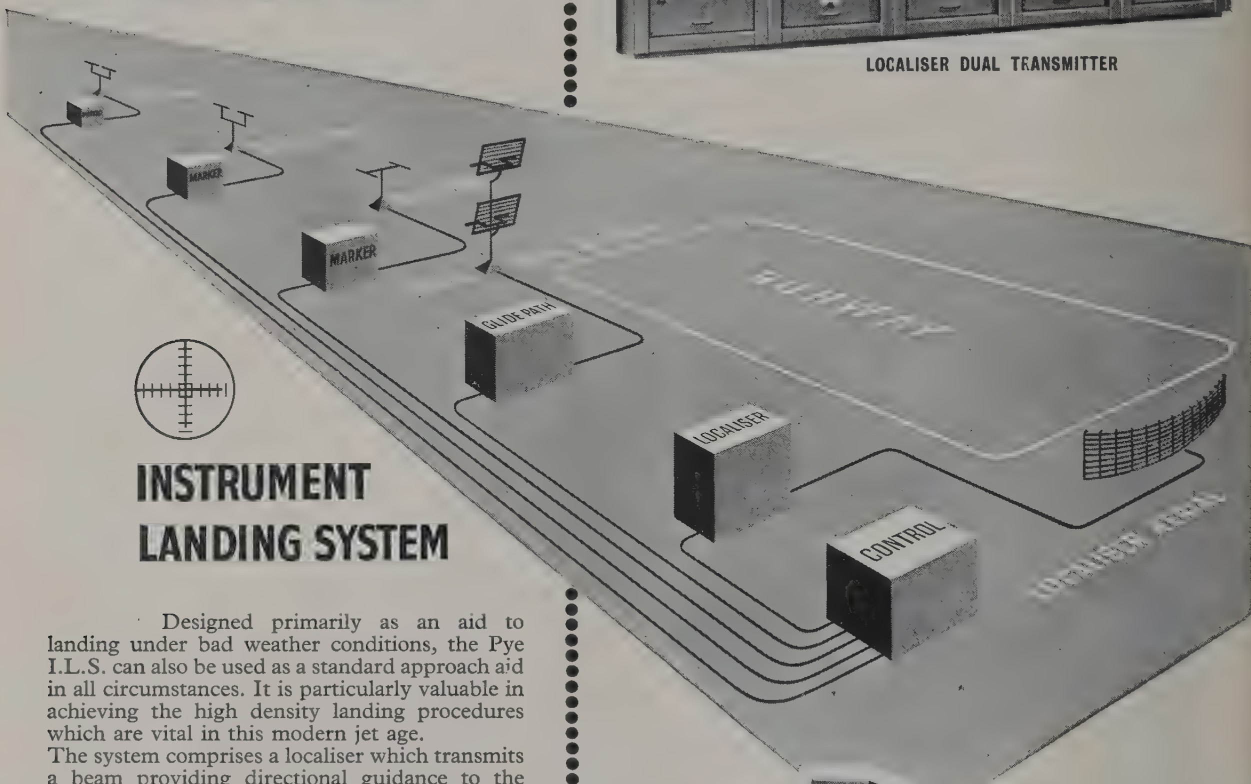


LOCALISER DUAL TRANSMITTER



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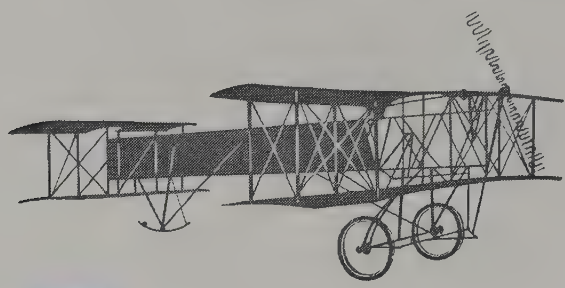

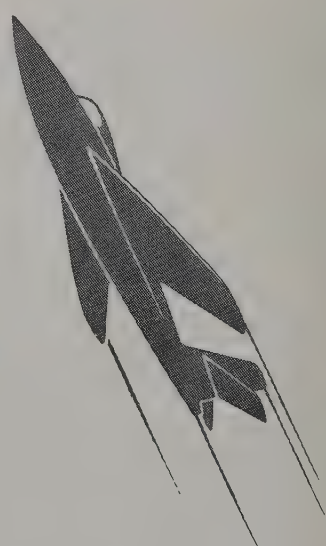

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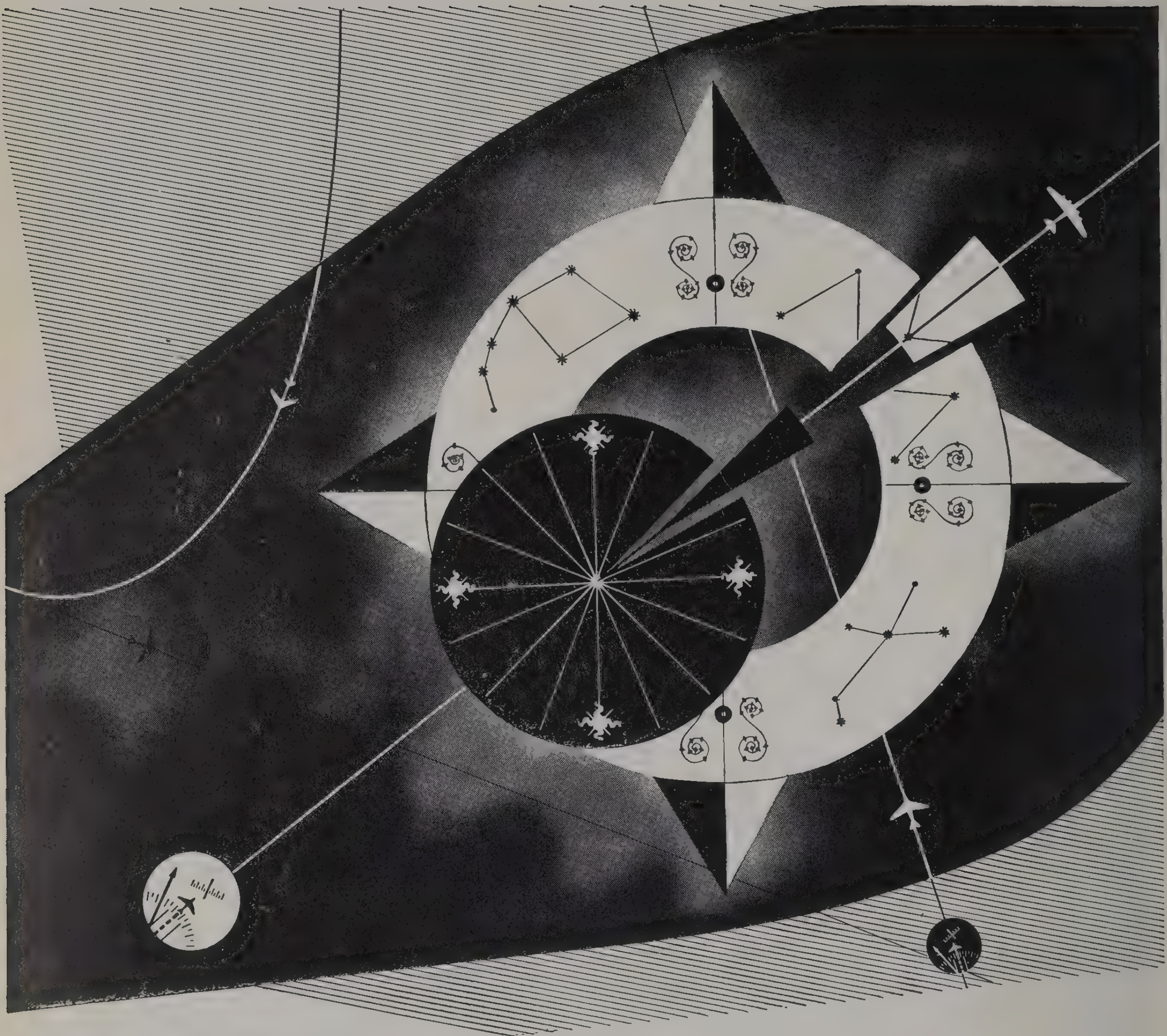

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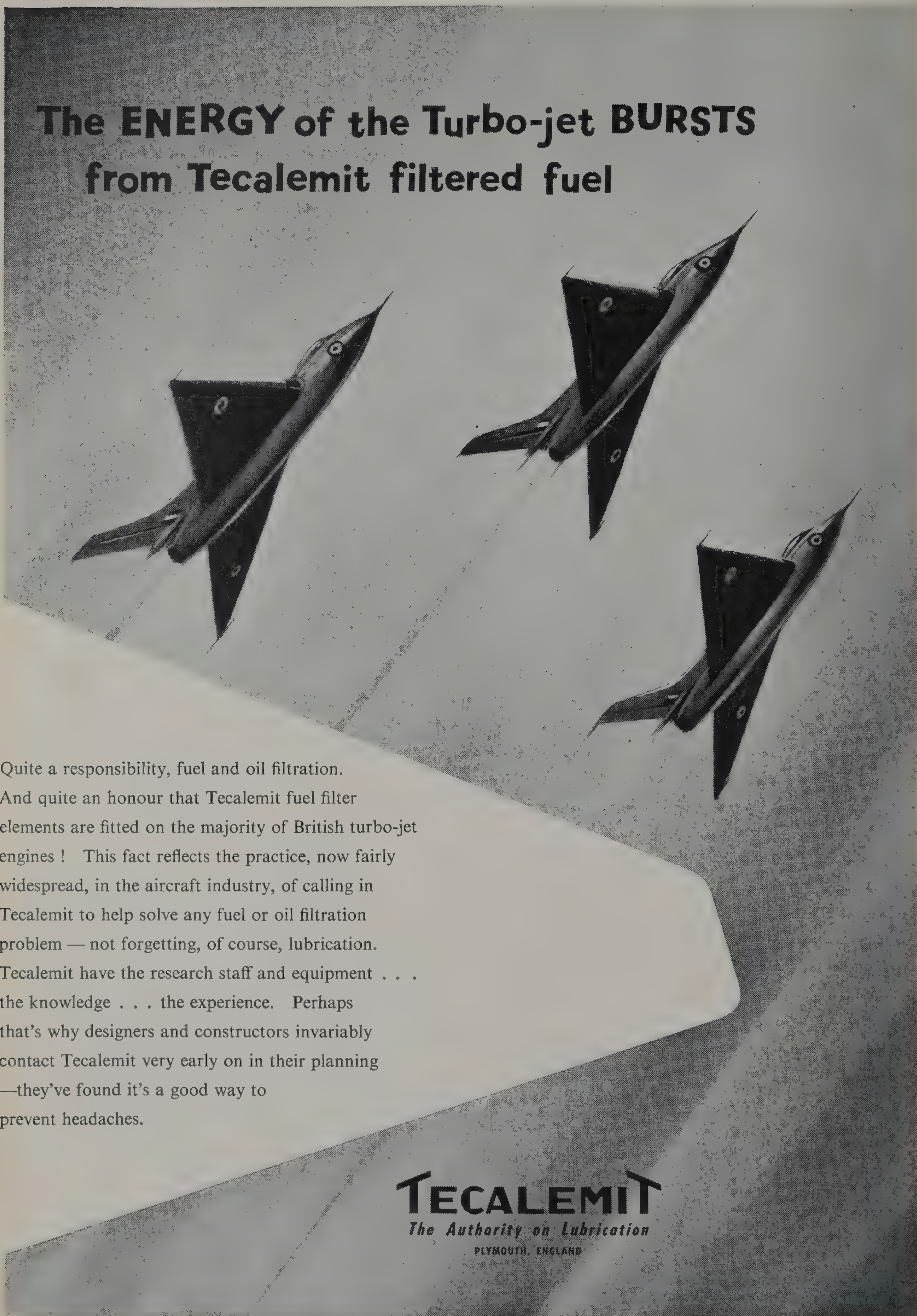
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